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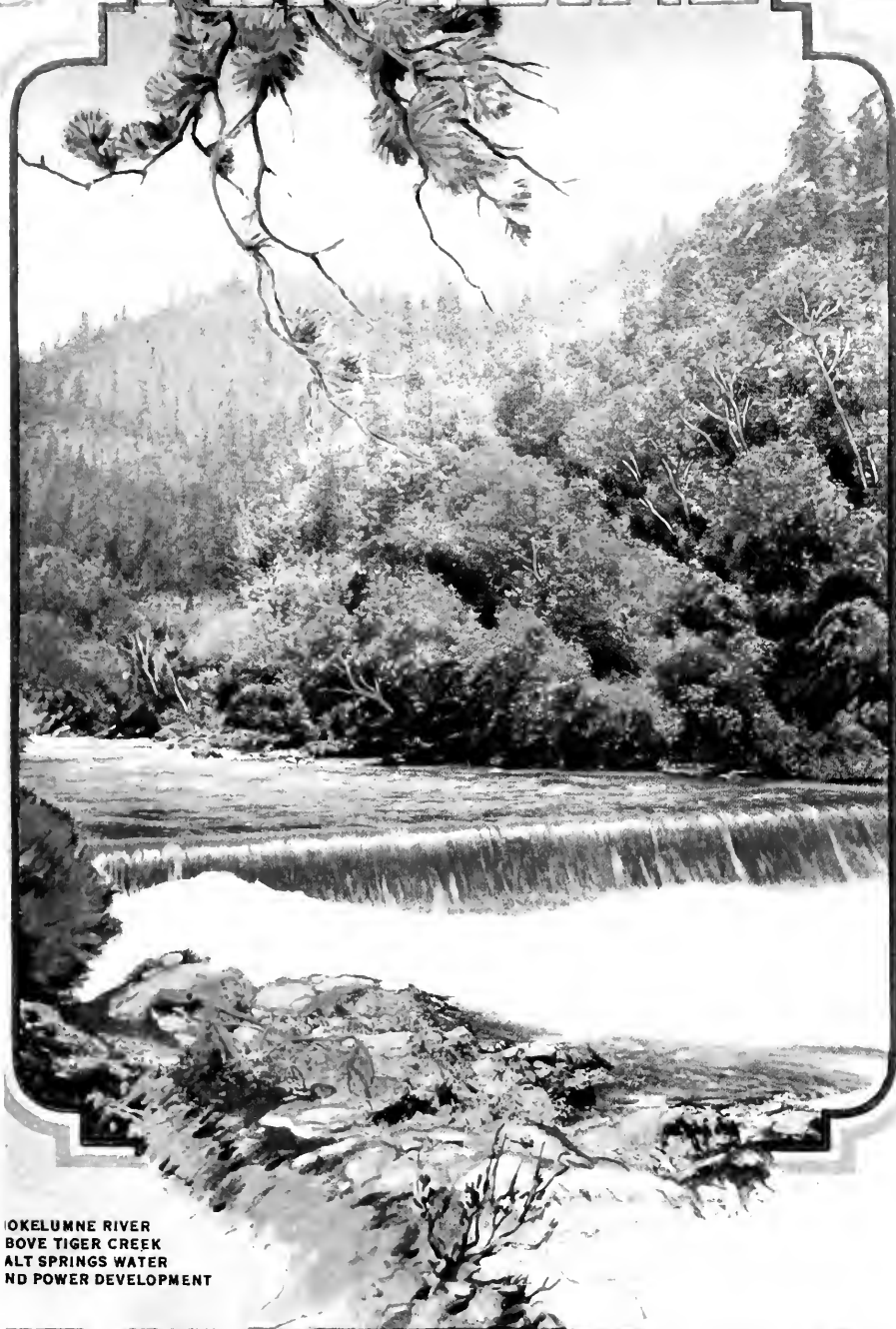








# PACIFIC SERVICE MAGAZINE



COKELUMNE RIVER  
BOVE TIGER CREEK  
ALT SPRINGS WATER  
AND POWER DEVELOPMENT

Vol  
18

JULY 1930

No

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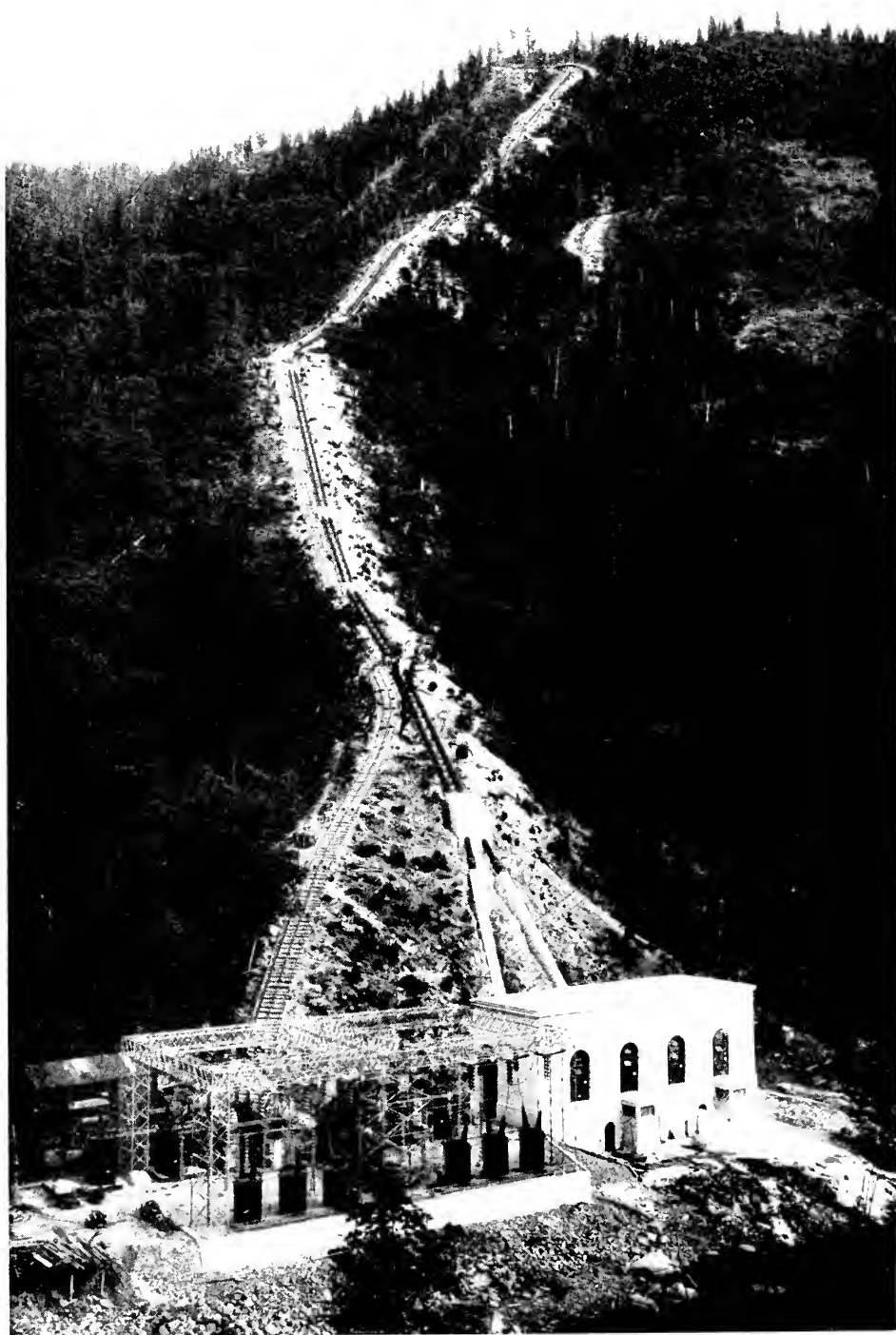
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Great Western Power Company's Bucks Creek power plant. Installed generating capacity, 67,000 horsepower. Head, 2,561 feet, the highest operating head in the United States.

# PACIFIC SERVICE MAGAZINE

Volume XVIII

JULY, 1930

Number 1

## *The New "Pacific Service" Merger*

*Great Western Power Company of California, San Joaquin Light and Power Corporation and Midland Counties Public Service Corporation, with their subsidiaries, affiliated with Pacific Gas and Electric Company.*

In the April number of PACIFIC SERVICE MAGAZINE our readers were advised that the Pacific Gas and Electric Company had entered into an agreement with the North American Company for the acquisition of its holdings in the three California utilities named above. The announcement of this constructive accomplishment has been received with general favor as a step of unusual importance in the direction of expansion of the territory covered by our company's operations and, also, enlargement and improvement of its facilities and service to its consumers. For, as stated at the time, the result of this merger will be to establish "Pacific Service" as not only the largest gas and electric company in the State but, also, among the three largest operating utilities of its kind in the United States, with assets of approximately \$650,000,000, gross revenues estimated to exceed \$87,000,000 annually, serving upwards of 1,200,000 customers, its field of operations a territory about 85,000 square miles in extent.

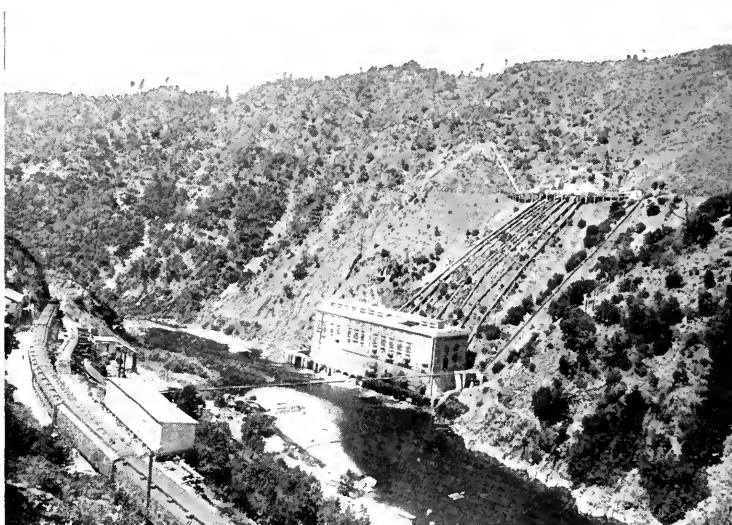
Co-ordination of facilities and administration of the various enterprises involved in the merger are expected to be of increasing benefit to both our company's customers and stockholders and will result in improved service, economies in operation, more efficient use of existing plant facilities, unification of construction programs to meet future requirements and the avoidance of future duplication of large capital investment.

Since the preliminary announcement was made the agreement has been consummated by the necessary exchange of stock between Pacific Gas and Electric and the North American Company. The work of adjusting the "Pacific Service" working organization to the new conditions is now in process. At this time, therefore, it seems fitting that our readers should be made acquainted with the leading features and general scope of the systems operated by the three California utilities whose affiliation with Pacific Gas and Electric Company is a most important item in the "Pacific Service" record of progress and development.

—Editor, PACIFIC SERVICE MAGAZINE.

# The Great Western Power Company

The history of the comprehensive hydro-electric water and power system controlled and operated by the Great Western Power Company dates back to 1901, when Mr. Julius M. Howells, a civil engineer practicing in Los Angeles, investigated the availability of the north fork of Feather River, in Plumas County, for water-power development purposes. Some twenty years previous, while carrying on certain work in Plumas County for Professor Agassiz of Harvard University, Mr. Howells had noticed near Big



Las Plumas power plant, at Big Bend, on the north fork of the Feather River. Installed generating capacity, 91,100 horsepower.

Meadows an unusual site for a water storage reservoir. Upon further examination of that region, he became so impressed with the elevation of Big Meadows and the rapid fall of Feather River below that point that he gave it as his professional opinion that there lay an opportunity for the development of a hydro-electric project of unusual magnitude.

His next step was to interest capital in the project of acquiring the reservoir site mentioned and the necessary lands along Feather River for dams, aqueducts, pole lines and power-house sites for utilizing the waters to be stored in the proposed Big Meadows reservoir and, also, the very considerable natural flow of the stream and its tributaries below that site. Mr. Howells succeeded in interesting Mr. E. T. Earl, of Los Angeles, and other prominent gentlemen sufficiently to induce them to make the preliminary purchase of lands at Big Meadows.

On March 24, 1902, the Western Power Company, a California corporation, was organized, and to this company the acquired lands and water rights were transferred. It was then found that at a point called Big Bend, 65 miles down the river from Big



Interior of Las Plumas power-house.

Meadows and about 16 miles from Oroville, a tunnel had been driven through the neck of an oxbow in the river to divert the waters from the channel around the Bend and thus bare the stream bed sufficiently to permit placer mining. This mining project had been started by the Big Bend Tunnel and Mining Company, a New York corporation organized by Dr. R. V. Pierce of Buffalo; but, although the tunnel had been completed as far back as the early eighties, the company as a mining project had failed to develop, either because of lack of gold or of the enormous expense involved in the work. The owners, however, had become alive to the opportunity there offered for water-

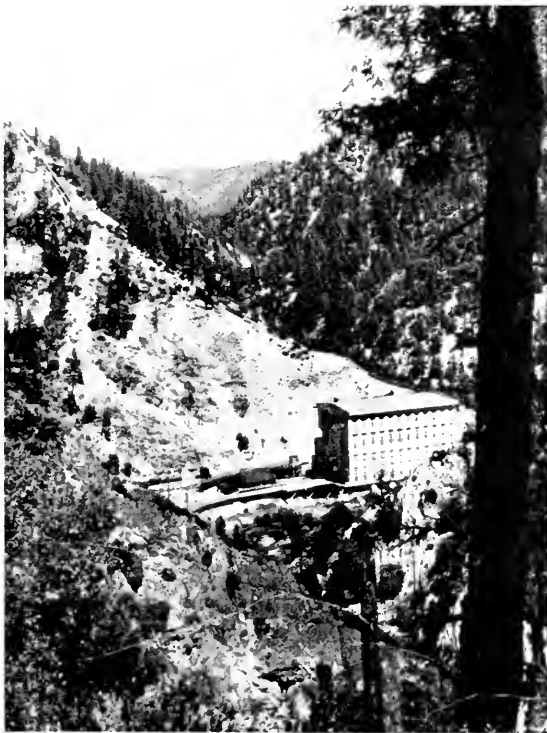


Club house at Las Plumas power plant.

power development and had transferred their rights to the Eureka Power Company, which already had under way a water-power project for a hydro-electric plant at Big Bend. The Western Power Company thereupon bought out the rights of the Eureka Power Company and united them with its rights at Big Meadows and the surrounding territory.

The company actively prosecuted its project throughout 1902, but the financial stringency of the following year prevented further financing for a while. In the year 1904, however, the promoters of the company succeeded in enlisting a number of New York capitalists in the enterprise, among them Mr. Edwin Hawley of New York City, Mr. Clarence Mackay, and some New York and Boston financiers who were already interested in water-power development in California. The result was the organization, in 1906, of the Great Western Power Company, to which were transferred all the rights of the Western Power Company in California.

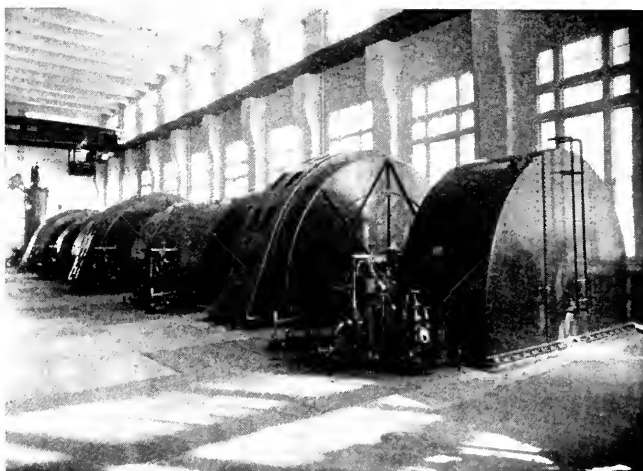
Construction work on the power project was first undertaken. The San Francisco disaster checked progress for a while, but such rapid recovery was made that by the fall of 1906 the work of enlarging the



Caribou power plant. Installed generating capacity, 88,000 horsepower.

Big Bend tunnel referred to above was begun and carried on actively until, in December, 1908, the Big Bend plant was completed and put into operation with an initial installed generating capacity of 40,000 k.v.a., or, in round numbers, 53,000 horsepower.

This plant, with transmission lines extending to Oakland and into the territory north of San Francisco Bay, the lands and reservoirs at Big Bend and several other undeveloped power sites below the reservoir and above Big Bend, constituted the properties of the Great Western Power Company at that time. Then the company began to acquire steam-electric service. In 1908 the California Electric Generating Company was organized by the Great Western Power Company for the purpose of constructing a steam-electric plant in Oakland. This was put into operation November 27, 1909. Another subsidiary, acquired in 1911, was the City Electric Company, which four years previous had been giving service in San Francisco from a steam plant in North Beach. This plant is of historical importance



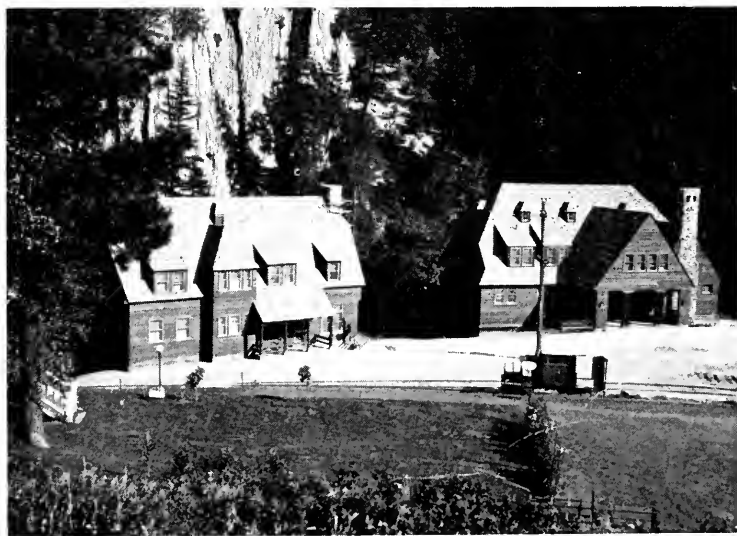
Interior of Caribou power-house.

for the reason that in January, 1912, the first submarine power cable under San Francisco Bay connected the City Electric Company's system with the hydro-electric lines of the Great Western Power Company.

In February, 1915, the Great Western Power Company incorporated the Consolidated Electric Company to accomplish the transfer to the Great Western Power Company of certain electric properties then controlled by the United Properties Company of California. These included a number of small steam-electric stations in San

Francisco and Oakland and the operation, under lease from the San Francisco, Oakland and San Jose Railroad, of a steam-electric station in Oakland from which the Key Route system of electric railways in Oakland and Berkeley was supplied with power under an exclusive contract.

These properties, then, constituted the nucleus of a system which at the present



Community center, at Caribou power plant.

time includes three hydro-electric plants, with an aggregate installed capacity of 246,100 horsepower, five steam-electric plants of a total installed capacity of 89,000 horsepower, 3,424 miles of transmission and distribution lines, and the largest water storage facilities of any power company in the United States.

The Big Bend plant, or Las Plumas, as it is generally called, for some years held pride of place as the largest hydro-electric generating plant west of the Mississippi River. Its initial generating capacity was subsequently increased by the installation of additional units, until today it is rated at 91,100 horsepower. Its potential development is estimated at 174,000 horsepower generating capacity.

It enjoys a picturesque location. The power-house is on the north bank of the Feather River opposite the line of the Western Pacific Railroad from which it is reached by a suspension bridge. It is a handsome building of steel frame and reinforced concrete walls. It is within easy reach from Oroville and its accessibility makes it a favorite spot for sightseers at all times of the year. The intake dam is ten miles upstream from the power-house. It is an arched concrete structure, with a maximum height of 80 feet and a crest length of 330 feet. From this point the water is diverted into the before-mentioned tunnel, enlarged and extended for the purpose, and carried through the mountain a distance of three miles. The outlet is on the face of the canyon wall directly above the power-house, where there is a head or drop of 465 feet.

The power generated at Las Plumas is transmitted across country to the company's high-tension distributing station at Oakland by means of a double-circuit steel-tower line



Butt Valley reservoir. Capacity, 50,000 acre-feet.

at a pressure of 100,000 volts. Distance, 154 miles.

Fifty miles upstream from Big Bend is the Caribou plant, whose construction began in June, 1919, and was completed two years later. This plant is supplied with water from Lake Almanor by means of a timber and reinforced concrete-lined tunnel having a length of 11,725 feet. The flow through the tunnel is controlled by means of a steel and concrete gate-house at the intake end. The water flows into Butt Valley reservoir, which has a storage capacity of 50,000 acre-feet. The dam creating this reservoir is of hydraulic fill earth type, with large reinforced-concrete spillways. The intake to the Caribou plant is located near the lower end of the reservoir and water is carried therefrom through a reinforced-concrete pressure tunnel about 9,200 feet long to a point above the power-house. Near this point is located a surge tank from which extends a short pressure tunnel terminating in three steel penstocks which branch into six lines part way down the hill. The Caribou plant operates under a head of 1,150 feet. The generating equipment consists of three generators, each of 22,223 k.v.a. capacity, giving the plant a total generating capacity of, in round numbers, 88,000 horsepower. This plant, however, has an ultimate potential development into one of 176,000 horse-



Lake Almanor, the great power reservoir at Big Meadows.

power capacity. After the water has spent its energy in turning the wheels at Caribou it helps swell the stream that rushes down to Big Bend.

Caribou may be reached either by automobile from Lake Almanor or by the Western Pacific Railroad from Howells, at the mouth of the north fork of the Feather River. From this point the company operates a standard-gauge railroad nine miles long which ends at the power-house. The camp equipment includes a new club house and dormitory, six cottages and a school house. The grounds are very beautiful. Flowers grow in profusion.

The third and newest generating plant of the Great Western system is the Bucks Creek power-plant, located at the junction of Bucks Creek and the north fork of Feather River, about 25 miles above Las Plumas. This plant was constructed by the Feather River Power Company, under an arrangement whereby the entire output of the plant for a period of 35 years would be sold to the Great Western, at the end of which period the ownership of the properties would

pass to the latter concern. This arrangement has recently been superseded by another under which the properties have been taken over and merged into the Great Western system.

This plant was completed and put into operation in March, 1928. Water for its operation is derived from Bucks Creek reservoir, located on the upper reaches of the stream, where there is a storage capacity of 104,000 acre-feet. At a point below the dam, water from the reservoir is diverted through a tunnel 5,753 feet in length to Grizzly Creek. It flows down the channels of this creek until it reaches the Grizzly Creek diversion dam, which impounds the water into a forebay from which it is conveyed through a pressure tunnel 9,575 feet in length to a twin penstock ending at the power-house. This penstock is 4,800 feet in length and has an average slope of 30 degrees. Additional water is obtained from Three Lakes reservoir and Milk Ranch Creek, carried to Bucks Creek by means of a conduit eight miles in length.

The power-house and equipment are of



storage capacity is rated at 1,300,000 acre-feet.

the most modern type. Power is obtained from two generators, each of 25,000 k.v.a. capacity, each of which is propelled by two Pelton water wheels operating under a static head of 2,561 feet. This holds the record as the highest head of any power plant in the United States.

To carry the current generated at Bucks Creek a steel-tower line extends down the canyon and through the valley to the Great Western Power Company's substation at Brighton, near Sacramento, a distance of 99 miles. This line was designed and constructed for operation at 220,000 volts but at the present time is operating at 165,000 volts.

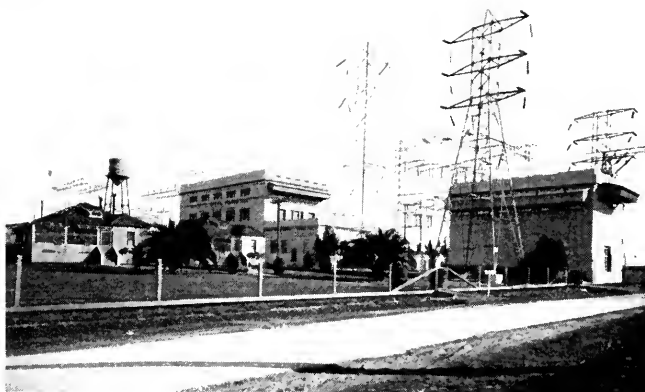
All three transmission lines from the power plants on the Feather River come together at Brighton substation. This station, also, marks the point of connection with the San Joaquin Light and Power Corporation, an affiliated company whose system was merged with that of the Great Western in 1925. A recently constructed line extends from Brighton to the San Joaquin company's Wilson substation, near Merced. This is

103 miles in length and, while constructed for 220,000-volt operation, is now operated at 165,000 volts. It carries the power which is generated by the San Joaquin Corporation on the Kings and San Joaquin rivers into the Great Western system, or, conversely, carries the power generated on the Feather River into the San Joaquin system. This interconnection has the value of placing the standby service of each system at the disposal of the other, an arrangement of the highest benefit to consumers.

Brighton substation, receiving this power from the San Joaquin Valley over the tie-line as well as that coming in over the four circuits from Feather River, is one of the main switching stations of the Great Western system. From Brighton the power is carried to the San Francisco Bay area by two tower lines. One of these follows a route to the west and crosses San Francisco Bay at Carquinez Straits on a span 4,753 feet in length between two steel towers, each of which is 195 feet high. This transmission line runs into the Great Western Power Company's Golden Gate substation, on the

Oakland side of San Francisco Bay. The other main tower line, carrying two circuits, travels down through the Delta region, where the Grand Island substation serves the highly developed reclamation districts with their important industrial loads and canning industries. This station also supplies power to river dredges operating for flood-control purposes. Continuing, this tower line crosses the San Joaquin River near Antioch, where an important substation serves the surrounding agricultural and industrial area. From Antioch this line runs to the Park Boulevard substation in Oakland.

The Golden Gate and Park Boulevard substations are interconnected with numerous tie lines, thus safeguarding service from interruption on either of the two tower lines



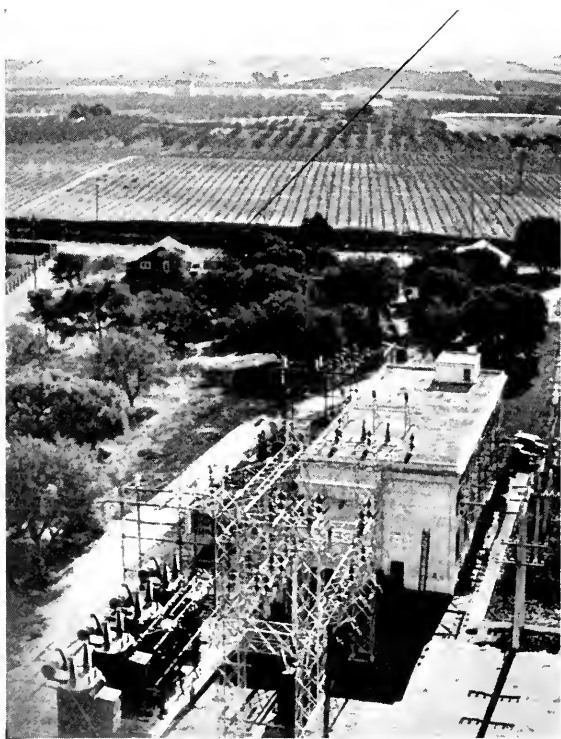
Brighton substation, northern terminus of the Great Western-San Joaquin tie line.

from Brighton. Extending along the bay shore from Golden Gate substation is a steel pole line to Valona substation that serves Napa, Santa Rosa, Petaluma and the industrial area adjacent to Martinez. This substation is also interconnected by tie lines with the Antioch substation. Load dispatchers at the Park Boulevard substation control the flow of power over more than 3,000 miles of transmission and distribution lines.

Under the waters of San Francisco Bay the power is carried by five submarine cables from the Golden Gate and Park Boulevard substations to San Francisco.

A most spectacular feature, naturally, is the great reservoir at Big Meadows, previously referred to as Lake Almanor. It is the primary source of power in the Great Western Power system. The initial storage development dates back from 1913, when a hydraulic-fill earth dam was built to a height of 65 feet, impounding 300,000 acre-feet of water. In 1926, the dam was raised 45 feet, thereby increasing the storage capacity to its present rating of 1,300,000 acre-feet.

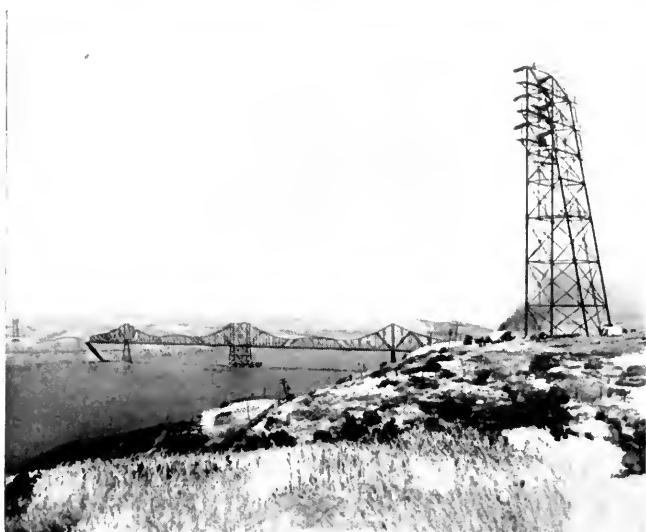
This mountain reservoir is greater in storage capacity than all the storage reservoirs of all other power companies in this State combined. It is in one of the heaviest rainfall and snowfall areas in California and practically controls the flow of



G. W. P. substation at Antioch.

the north fork of the Feather River. When full, the reservoir covers an area of 45 square miles, practically the same as the area of the City and County of San Francisco. Measured in gallons, the customary unit for expressing capacity of reservoirs used for municipal water supplies, the capacity of Lake Almanor is 423,635,440,000 gallons, or enough water to supply San Francisco, for domestic and manufacturing purposes, for more than a quarter of a century at the present rate of consumption. If all the water Lake Almanor can hold were impounded in the area of Golden Gate Park, it would be 1,000 feet deep, or more than twice the height of the Russ Building in San Francisco.

Engineers estimate that this vast body of stored water makes possible the ultimate generation of 1,000,000 horsepower of electric energy in ten power plants. Of this potential total 246,100 horsepower has been



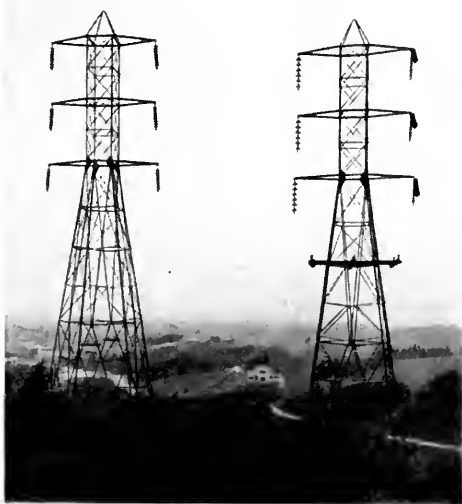
Where Great Western Power crosses the Carquinez Strait.

developed to date.

The main outlet is at Prattville, where water is carried by means of a tunnel to the Butt Valley reservoir and thence to the Caribou power-house. When the Prattville outlet tower was being raised, the Associated Sportsmen asked the Great Western Power Company to screen the outlet. A satisfactory plan of screening was finally agreed upon. The problem was rather involved, as there are 100 feet difference in elevation between high and low water, and the screen had to be fool-proof and built in such a manner that it would not choke up.

Great numbers of fish are taken each year from the lake. The Lake Almanor rainbow grow to enormous size, several having been taken over 20 pounds in weight. The Fish and Game Commission operates four egg-taking stations on the tributaries of Lake Almanor at Rice Creek, Warner Creek, Clear Creek and Butt Creek, where about 2,000,000 eggs are taken each year. These are hatched at Dominguez Springs and Clear Creek hatcheries and the fry are planted in tributary streams.

The storage of Lake Almanor has greatly benefited fishing conditions in the north fork and the main Feather River. Before the completion of the dam, the natural flow in summer became very low and in the years of drought, such as 1920 and 1924, there was hardly enough water to support large numbers of fish. Now, however, the largest



Great Western tower lines crossing the foothills near Oakland.

outflow of water from Lake Almanor occurs during the summer and, in place of the normal stream of summer months, an average daily flow of nearly 1,000 second-feet is released.

Lake Almanor is easily accessible by automobile. There is an excellent road by way of Red Bluff and another in from Chico via Butte Meadows. Caribou power-house is about an hour's ride. Within a short distance of the lake is the Mt. Lassen National Park. A trip to the hot springs and the Devil's Kitchen is well worth while. There is an excellent road completely around the lake passing through the town of Westwood, one of the largest lumbering towns in the country, where the most modern sawmill methods may be seen.

By way of standby service, safeguarding the continuous flow of power from the company's hydro-electric sources, the Great Western system operates five steam-electric stations, one in Oakland and four in San Francisco, of a combined installed generating capacity of 89,000 horsepower.

The Oakland steam plant, constructed by the California Electric Generating Company

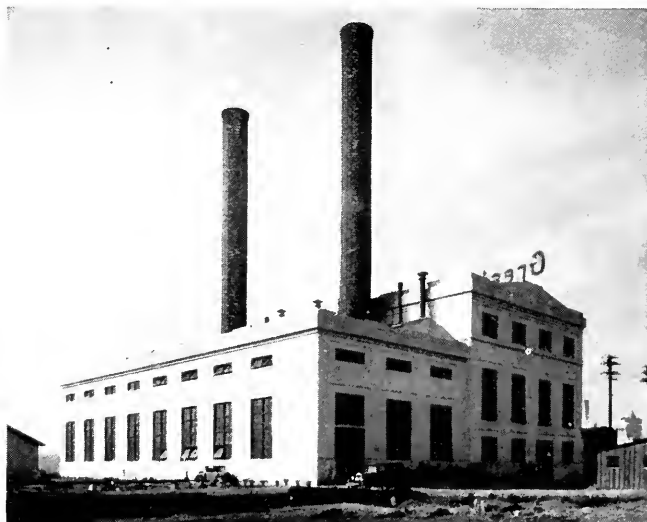


Park Boulevard substation, Oakland.

in 1909 and since that time operated under lease by the Great Western, is located at the foot of Fifth Avenue, Oakland, on the shore of the estuary. Its equipment consists of three units, each of 3,500 k.v.a. capacity. Condensing water is obtained from the estuary, while boiler feed water is obtained from wells and city water supply. Oil fuel is used exclusively.

The North Beach steam plant, in San Francisco, is that previously referred to as constructed by the City Electric Company and placed in operation in 1907. It is located at the corner of Beach and Mason Streets, on the shore of the bay. Its installed capacity is 16,000 k.v.a. Condensing water is obtained from the bay, while boiler feed water is obtained from the city water supply. Oil fuel is used exclusively.

The Bush Street steam plant is located at 530 Bush Street. It is used to supply steam to the company's distributing system and, also, generates electric energy. It was originally constructed in 1916, and in 1917 two 2,500-k.v.a. units, which were formerly at the North Beach station, were installed. In addition to the steam plants, the building houses



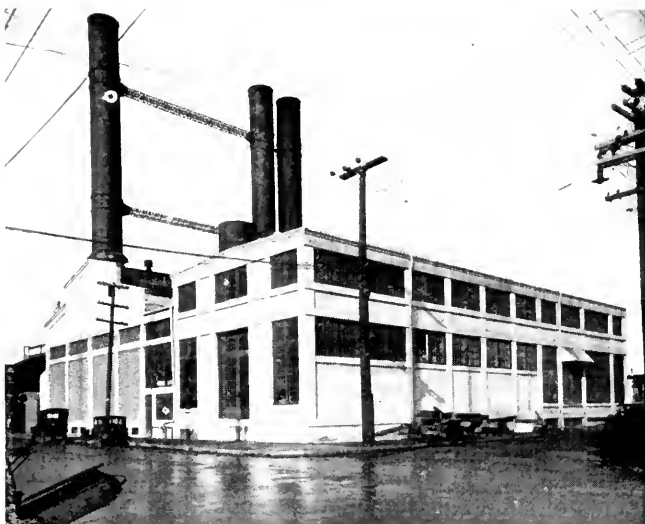
G. W. P. steam-electric station at Oakland.

an electric substation.

The Phelan Building plant is located in the basement of that building, leased for the purpose. It was originally installed by the United Light and Power Company and went into operation in 1909. This plant supplies steam heat to the company's distributing system and contains two steam turbines which are normally operated in accordance with the demand for low-pressure steam. The installation consists of two 750 k.v.a. turbo-generators.

Within the last year a fourth steam-electric station, and the largest on the system, was placed in operation. This is located at India Basin, on the bay of San Francisco, and has an installed capacity of 35,000 kilowatts, with potential development up to 170,000 horsepower.

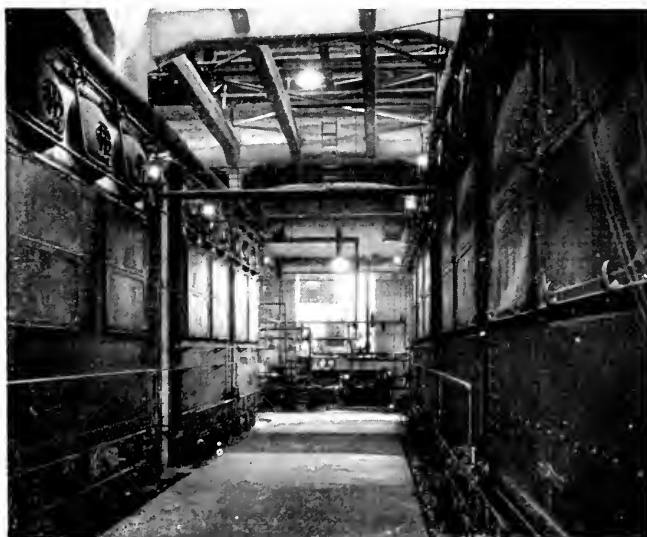
The plant occupies a twenty-acre site, affording ample room for storage of fuel and other supplies as well as subsequent expansion. The main building is of steel and concrete structure, with heavy foundations and substructure of water-chambers



North Beach steam-electric plant, San Francisco.

and tunnels reaching to the bay. Two boiler drums 40 feet long and 7 feet in diameter, each weighing 75 tons, are said to be the largest drums of this particular type ever built. All machinery is of the most modern type, the equipment including a compact 35,000-kilowatt turbo-generator. The present plant was constructed with provision for additions, when required, of three units of the same size as the first. The plant's location in the heart of the San Francisco industrial district and on the bay shore makes it accessible to both rail and water transportation.

During 1929 the company's plants produced 1,049,765,324 kilowatt-hours, an increase of 20.94 per cent over the previous year. Of this total 1,030,649,037 kilowatt-hours were produced by hydro-electric plants, 19,116,287 by steam plants. In addition, 5,477,932 kilowatt-hours were purchased, and 7,920,000 were received in interchange from the San Joaquin Light and Power Corporation through the connecting transmission line between Merced and Brighton. The peak load



Boiler room at North Beach steam plant.

of the system was recorded on August 21st, totaling 192,360 kilowatts. Consumer meters connected to the lines numbered 75,704 as of December 31, 1929.

A subsidiary company not so far mentioned is the Napa Valley Electric, taken over by the Great Western in 1925. The properties include a sub-station at St. Helena and a distribution system extending over the Napa Valley. In all, there are 3,424 miles of transmission and distribution lines in the Great Western system. Its operations extend over 13 counties of northern and central California, Plumas, Butte, Yuba, Placer, Sacramento, Yolo, Solano, Napa, Sonoma, Contra Costa, Alameda, San Francisco and San Mateo.

The system's gross operating revenues for the year were \$10,212,745, an increase of \$752,772 over the preceding year, or 7.96 per cent. Of these revenues 96.22 per cent was derived from the sale of electricity, the balance coming from sales of steam heat in San Francisco and Oakland, and miscellaneous sources.

Total operating expenses, including maintenance and taxes, were \$2,913,396, as compared with \$2,976,123 for the previous year, a decrease of 2.11 per cent. Taxes, always one of the larger items of operating expense, were \$941,066, or \$51,749 greater than for 1928. Ratio of operating expense and taxes to gross revenue was reduced from 31.46 per cent to 28.53 per cent. Total income reached \$7,309,411, as against the 1928 fig-



New steam-electric station at India Basin, San Francisco.

ure of \$6,516,748, an increase of 12.16 per cent. Net interest deductions were \$3,574,787, including amortization of bond discount and expense. The depreciation reserve was credited with \$830,520, leaving net income for dividends of \$2,904,103. Preferred stock dividends of \$1,417,381 were paid, leaving a balance of \$1,486,722.

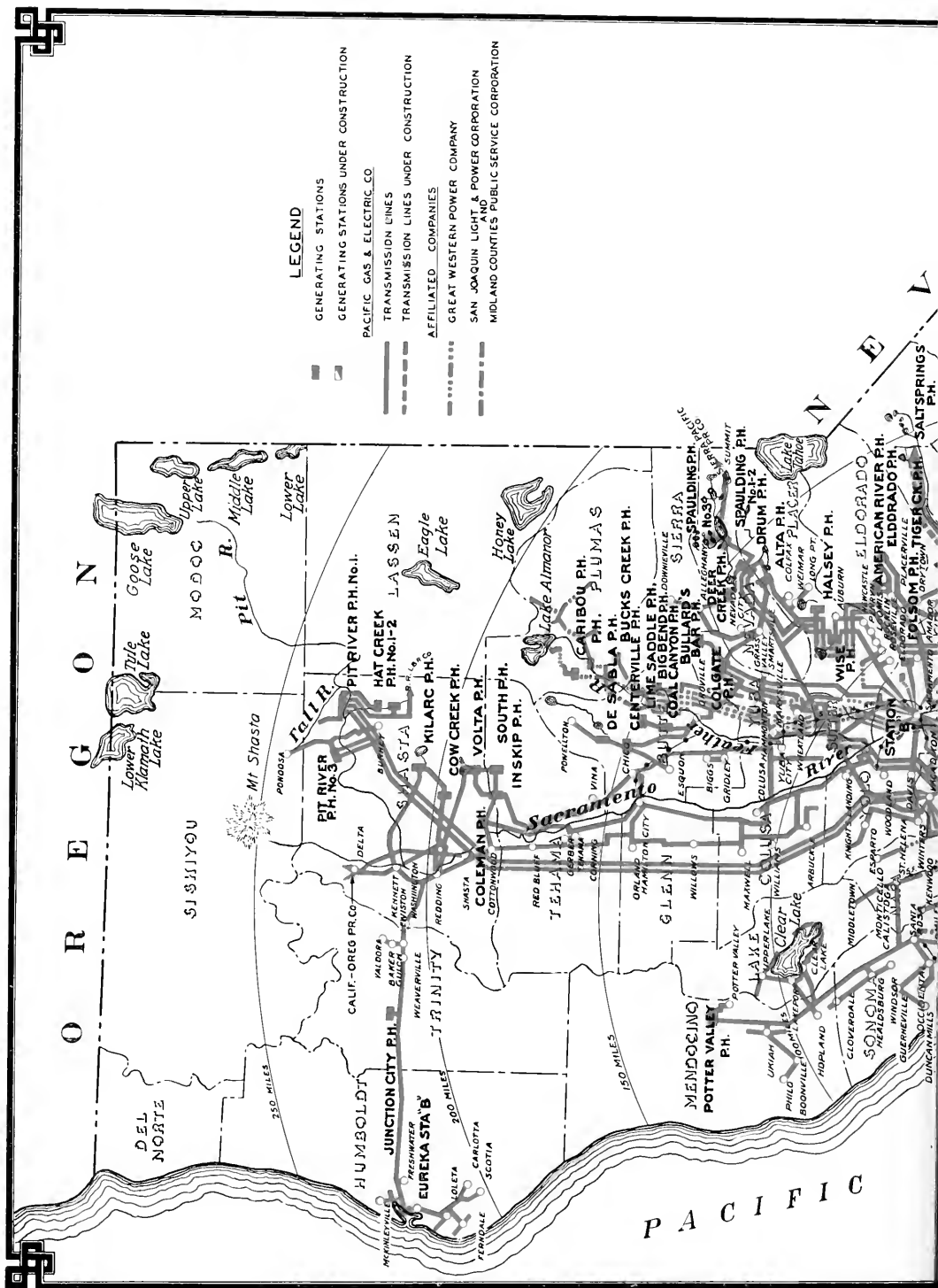
Total investment in property, plant and franchises at the end of the year was \$124,164,303, an increase of \$5,300,347, representing capital expenditures. The year's program was financed by additional cash advances from Western Power Corporation, which on December 31, 1929, amounted to \$14,859,635. Funded debt on that date amounted to \$52,180,450, and outstanding preferred stocks of the company and subsidiaries totaled \$21,297,200.

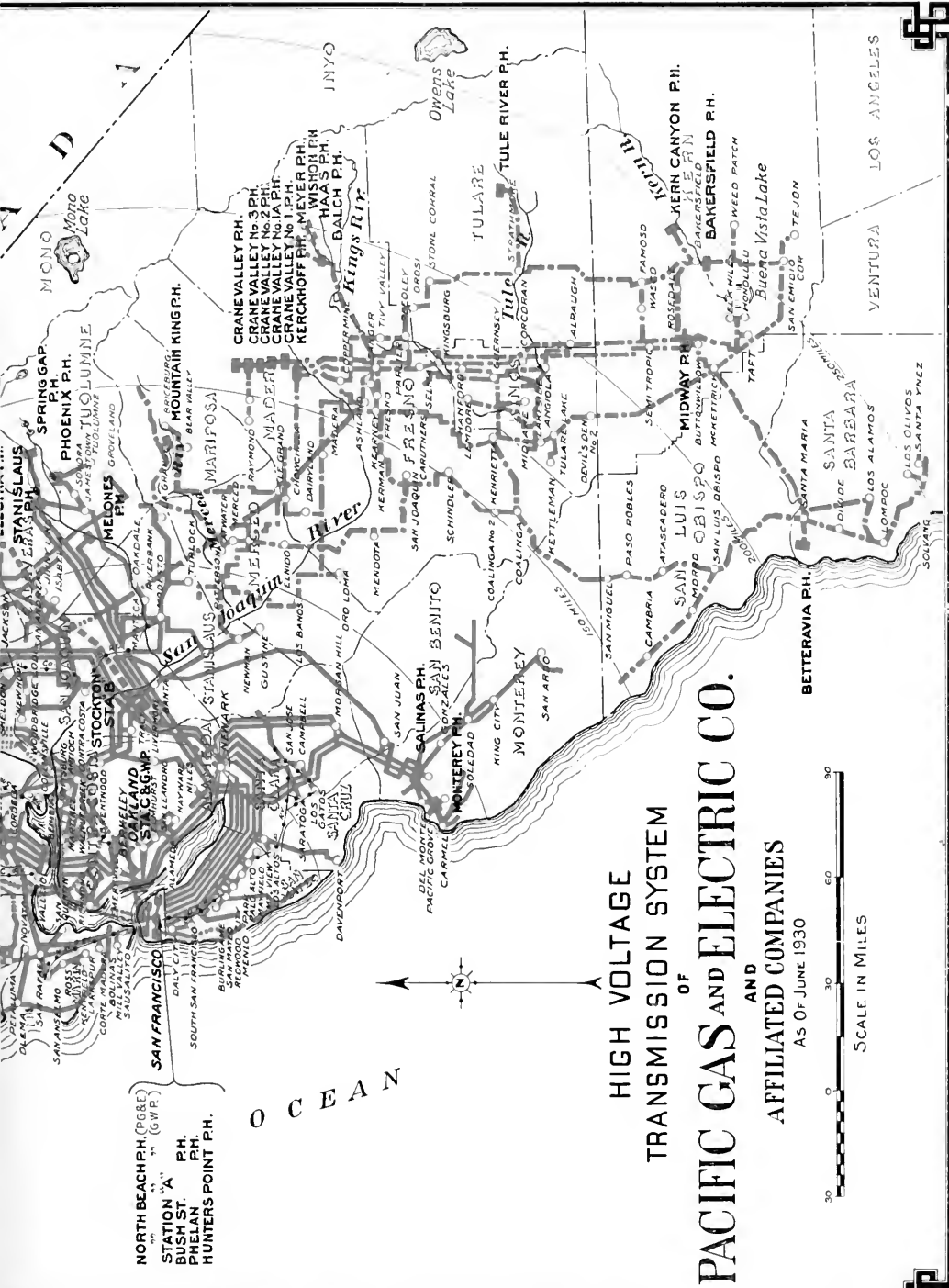
Reserves at the close of the year amounted to \$5,443,168 and surplus to \$6,275,503.





Kerckhoff Dam, on San Joaquin River, 36 miles from Fresno.  
San Joaquin Light and Power System.





# HIGH VOLTAGE TRANSMISSION SYSTEM OF PACIFIC GAS AND ELECTRIC CO. AND AFFILIATED COMPANIES AS OF JUNE 1930

SCALE IN MILES

## *San Joaquin Light and Power Corporation*

The story of the development of the present San Joaquin Light and Power Corporation dates back to 1895, when the San Joaquin Electric Company was organized for the purpose of developing hydro-electric power on the north fork of the San Joaquin River.

The enterprise was prompted by the success of the experiments in long-distance power transmission from the Pomona and Mill Creek plants in Southern California. These dated from 1892 and were the earliest examples of long-distance transmission in the State. In 1894, Mr. John S. Eastwood, a civil engineer practicing in Fresno, made an investigation of various power sites lying within a radius of what at that time was possible transmission. The most feasible site found was along the north fork of the San Joaquin River. Water could be diverted at a point where the stream started to drop rapidly into the canyon of the main stream and thence carried along and across the end of a flat-topped point around which the main river curved at what is locally known as Horseshoe Bend. The fall both in the north fork and in the main stream—nearly

9 miles of channel—could thus be utilized with a conduit about 5 miles long. The available head, or drop, to the power-house site was over 1,400 feet and seemed rather high for safety of operation; nevertheless, tentative plans for the development were completed and in the next year, the San Joaquin Electric Company having been organized for the purpose, work was started.

In May, 1896, San Joaquin plant No. 1, as it was called, was put into service. Its generating capacity consisted of three generators, each of 350-kilowatt capacity, propelled by three Pelton waterwheels rated at 500 horsepower each. Power was stepped up by six 125 k.w. air-blast transformers to 11,000 volts for transmission to a substation at Fresno, a distance of 36 miles.

The company encountered many difficulties. The proper installation of 36 miles of transmission lines was a hard problem. Second, the company had to introduce electric light in the face of active competition from a well-established gas company. Third, the enterprise was hampered by lack of capital to make extensions and improvements. As a result, in August, 1899, the system went



Power-house No. 1, on San Joaquin River. Capacity 22,800 h.p.  
Kerckhoff Lake in foreground.

into the hands of a receiver, by whom it was operated until December, 1902, at which time the company and its properties were purchased at a receiver's sale by the San Joaquin Power Company, organized for the purpose by Messrs. W. G. Kerckhoff and A. C. Balch, of Pacific Light and Power Company of Los Angeles.

The only development work undertaken by the new company was the installation of an additional unit at San Joaquin plant No. 1, bringing its capacity up to 1,400 k.w. The south end of the main transmission line was Hanford. In 1905, the San Joaquin Light and Power Company was organized in order to finance the construction of new generating stations and extend the transmission and distribution system. In



Interior of San Joaquin No. 1 power-house.

April, 1906, the new company added San Joaquin plant No. 3, above plant No. 1, on the north fork of the San Joaquin River, with an installed capacity of 2,000 k.v.a., and extended its transmission lines in a southeasterly direction down the San Joaquin Valley as far as Selma, Reedley and Kings River. It also carried a line westward as far as Coalinga to supply the distribution system owned by the same interests. The company also built a steam auxiliary station of 1,000 k.w. capacity in Fresno. Later on, in 1909 and 1910, the company completed most of the construction of a new San Joaquin plant No. 1, to replace the other, and of a new dam and reservoir in Crane Valley.

In addition to development of the electric system, San Joaquin Light and Power Company organized or acquired control of several local light and water companies. Among these was the Fresno Gas and Electric Company, which operated a steam plant and an electric distribution system. In 1909 Messrs. Kerckhoff and Balch organized the Coalinga Light and Power Company, later on reorganized as the Coalinga Water and Electric Company and now known as the Midland Counties Public Service Cor-



Kerckhoff power-house. Installed capacity, 52,300 horsepower.

poration. This latter concern purchased all its power from the San Joaquin Company.

In 1910 a further reorganization took place and the present San Joaquin Light and Power Corporation sprang into being. This was organized for the purpose of acquiring the properties of the San Joaquin Light and Power Company and, in addition, the Merced Falls Gas and Electric Company, operating in and around Merced, and the Power Transit and Light Company, operating in and around Bakersfield. The Merced Falls was a local transmission and distributing system, served from a 225 k.v.a. hydro-electric plant at Merced Falls. The Power Transit and Light Company owned and operated a 1,350-k.v.a. hydro-electric plant at the mouth of Kern Canyon, from which power was transmitted to Bakersfield and vicinity. The new company immediately proceeded to complete the construction of the new San Joaquin plant No. 1 and the Crane Valley dam and began work on new transmission lines to consolidate the entire system, including the construction of a large steam reserve station at



Balch power-house, on Kings River, 50 miles from Fresno. Installed capacity, 42,200 horsepower. Head, 2,381 feet.

Bakersfield. In 1913 the corporation also began construction of a transmission line extending westward from Coalinga to San Luis Obispo and Santa Maria, under contract with Midland Counties Public Service Corporation, and in August, 1916, displaced the old steam plants on the coast system with the larger Betteravia steam plant.

Today the San Joaquin Light and Power system embraces 11 hydro-electric plants, with an aggregate installed generating capacity of 154,825 horsepower, and three steam-electric stations, with a combined generating capacity of 69,466 horsepower. In the way of transmission and distribution there are 523 miles of 110,000-volt transmission lines, 996 miles of 70,000-volt secondary transmission and 7,385 miles of 11,000-volt distribution lines.

Five hydro-electric plants are located on the north fork of the San Joaquin River, northeast of Fresno. The north fork rises on the southern slope of Iron Mountain, at an altitude exceeding 8,000 feet above sea-level, and flows nearly south to a



Tule River power-plant—21 miles from Porterville. Capacity 6,850 h.p.

junction with the main river. Thirteen miles, in an air-line, from its source lies Crane Valley dam and reservoir, which is the main source of water supply for the five plants mentioned which form the main Crane Valley system. The present Crane Valley dam is an enlargement of the original structure that was built some twenty years ago. It is of hydraulic earth-fill and rock-fill type, with a concrete core wall. The dam is 145 feet high and impounds 45,000 acre-feet of water from the north fork of the river. It lies about 60 miles north of the city of Fresno. From this reservoir the water flows down stream to be used successively at six power houses, whose aggregate generating capacity is rated at 86,667 horsepower.



Crane Valley dam and reservoir, on the north fork of San Joaquin River.

The five plants on the north fork include: Crane Valley power-plant, just under the dam, with a generating capacity of 1,070 horsepower; power-plant No. 3, generating 5,780 horsepower; power-plant No. 2, five miles further down stream, generating 4,150 horsepower; power-plant No. 1-A, a small-head plant of 567 horsepower capacity, and power-plant No. 1, the largest and oldest of the system, located seven miles below plant No. 2, whose installed generating capacity is rated at 22,800 horsepower.

Kerckhoff power-plant is the largest and most modern of those deriving their source of supply from the San Joaquin River. It is located on the main stream, 30 miles northeast of Fresno. This plant was put into operation in 1920. A dam 97 feet high and 540 feet in crest length diverts water for its operation through a tunnel 17,300 feet in



Kern Canyon power-house, on Kern River, 17 miles east of Bakersfield. Capacity, 14,133 h.p.

length. At the outlet there is a surge chamber, from which there is a drop of 1,523 feet to the power-house. The generating equipment includes three units, with a total generating capacity of 52,300 horsepower.

Two 110,000-volt transmission lines leave the power-house, one running 39 miles south and tying in with the transmission system at Sanger substation, the other running 64 miles west and connecting with the main system at Merced.

Balch power-house, on Kings River, is the newest hydro plant on the company's system. At the time of its completion, in 1927, the static head of 2,381 feet under which this plant operates was the highest in the United States. This record is now held by the Bucks Creek plant of the Great Western Power Company.

A single generating unit, one of the largest in the country, develops 42,200 horsepower at this plant. Other features of the power-house which have attracted wide attention throughout the United States include a tunnel 19,348 feet long, drilled through a mountain of solid granite from the diversion dam to the penstock, and a high-head penstock 60

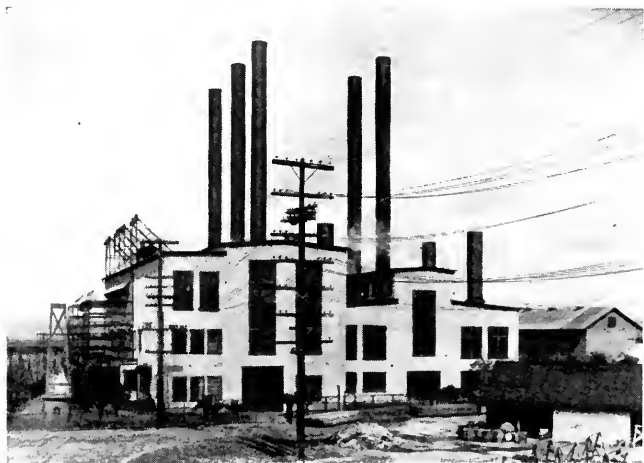


Crane Valley power-house, No. 2. Capacity, 4,150 h.p.

inches in diameter and 4,882 feet in length.

With the construction of Balch power-plant, the San Joaquin Light and Power Corporation first tapped the great potentialities of the swiftly flowing Kings River, one of the best power sources in the State. Completion of the power-house marked the first step in a long-contemplated power project, under which the San Joaquin Company plans the development of 500,000 horsepower along Kings River. A twelve-mile road blasted into the face of the solid granite cliffs has already been completed above Balch power-house, leading to the proposed site of one of the large upper reservoirs included in the plan. Nine plants are contemplated in the eventual development, which is expected to proceed as power demands of the valley increase.

In the mountains bordering the southern part of the company's system are plants on Tule River, in Tulare County, and on Kern River, in Kern County. Tule River power-house, situated about twenty-one miles from Porterville, develops 6,850 horsepower. This plant was built in 1914. Kern Canyon power-house, sixteen miles east of Bakersfield, has a generating ca-



Bakersfield steam-electric station. Capacity, 32,800 horsepower.

capacity of 14,133 horsepower. This plant was completed in 1921.

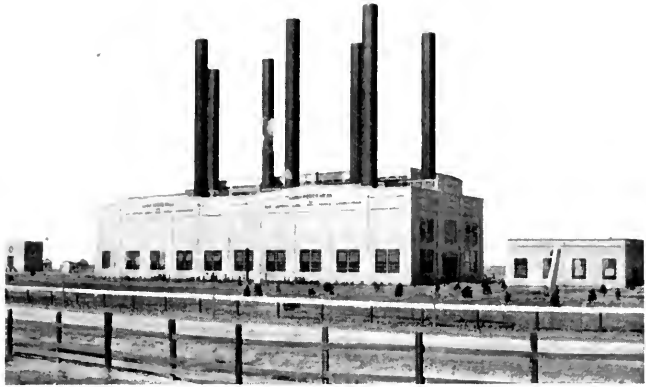
On Merced River, above Merced, are two small plants. At Merced Falls, on a site which has provided water power during a period of more than 75 years, the power-plant has just been completely rebuilt, being placed in operation in July, 1930. A capacity of 4,600 horsepower is provided at this plant. The other powerhouse is Mountain King, a small plant of 375 horsepower.

Supplementing the company's hydro plants are those of two irrigation districts from which San Joaquin Power purchases power. The total output of the Merced Irrigation District's 33,333-horsepower plant at Exchequer dam, on Lake McClure, is contracted for purchase by this company. Power is also obtained from the 22,450-horsepower Dom Pedro powerhouse of the Turlock Irrigation District on the Tuolumne River.

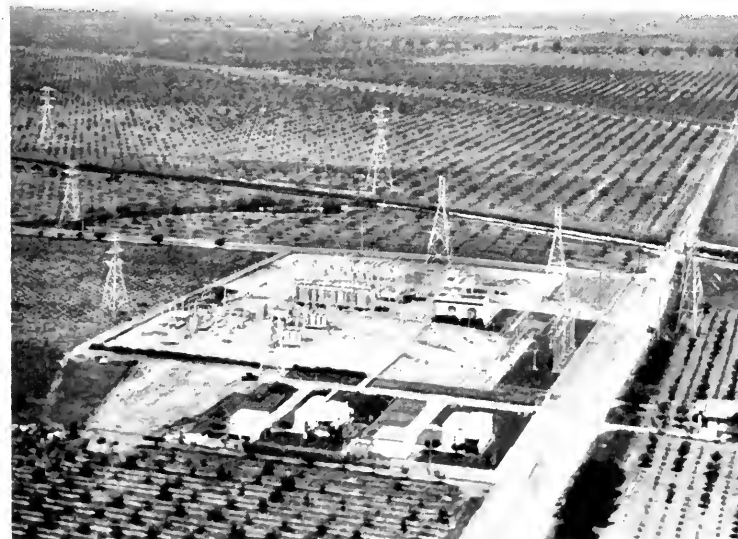
Three steam-electric stations on the San Joaquin Power system offer supplementary generating facilities which are used in the

fall of the year and at other periods of low water supply. Midway plant at Buttonwillow, twenty-five miles west of Bakersfield, has a capacity of 33,333 horsepower. Bakersfield steam plant, at the city of Bakersfield, develops 32,800 horsepower. These two plants are located near the plentiful sources of oil and natural gas fuel of Kern County. The third plant, which is not now in active service, is Betteravia steam plant, near Santa Maria in Santa Barbara County. This small plant has a capacity of 3,333 horsepower.

Coming into the San Joaquin Power main transmission system from the north is the 103-mile high-voltage line which is the avenue of power exchanged between this company's lines and those of the Great Western Power Company. This tie-line, which is now operated at 165,000 volts but is built for ultimate operation at 220,000, extends from Brighton substation, near Sacramento, to Wilson



Midway steam-electric station, at Buttonwillow.  
Capacity, 33,333 horsepower.

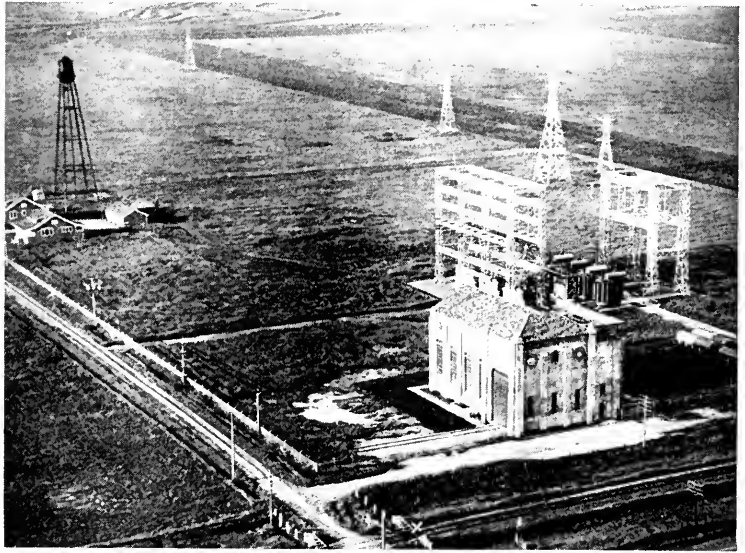


New Ashlan substation, north of Fresno, 50 miles from the Wilson substation at Merced, San Joaquin Light and Power system.

substation, near Merced. During the past year 205,458,000 kilowatt-hours of electricity were exchanged over this line, effecting operating advantages for both companies.

Wilson substation, the San Joaquin terminal of the tie-line, also forms the northern terminal of the main transmission system of the company. The substation has a capacity of 120,000 horsepower, with provision for increasing this capacity to 240,000. The four giant 165,000-volt transformers at this substation were the largest of their type ever built at the time of the substation's construction in 1926.

The 110,000-volt lines which form the



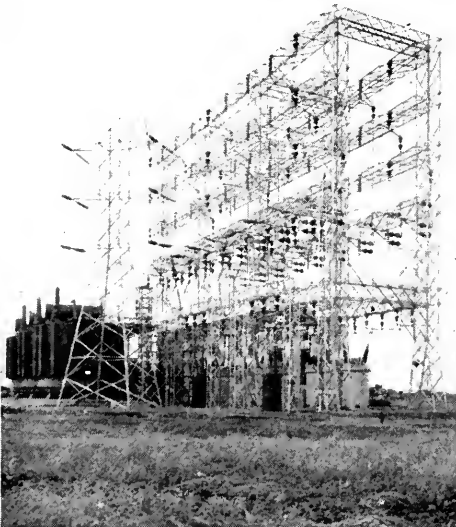
Wilson substation, near Merced, southern terminal of the tie-in line connecting the San Joaquin system with that of the Great Western.

backbone of the transmission and distribution system of the company extend from Merced in the north across to Kerckhoff power-house, down the valley through Sanger, Corcoran, Buttonwillow, and McKittrick, and then across the mountains to Santa Maria, in Midland Counties territory.

Supplementing these lines, forming a double high-transmission avenue between the northern and central parts of the San Joaquin system, is a new 48-mile line completed in July of this year from Wilson substation to Ashlan substation, just north of Fresno. This line is designed for ultimate operation at 220,000 volts, and is the same type of construction as the Brighton-Wilson tie-line, which it joins.

This primary transmission system feeds into a loop skeleton system of secondary 70,000-volt transmission lines, as well as directly into the 11,000-volt distribution network which reaches out from this central line to cover the entire territory. Transmission and distribution systems of the San Joaquin Company are made up of 523 miles of 110,000-volt transmission line, 996 miles of 70,000-volt secondary transmission line, and 7,385 miles of 11,000-volt distribution line.

Fifty-seven substations are operated on the San Joaquin Power system, with a total capacity of 276,110 k.v.a.



Outdoor transformers, circuit-breakers and bus structure, Wilson substation.

Extending through seven counties of the San Joaquin Valley, including Merced, Madera, Fresno, Kings, Tulare, Kern, and Mariposa Counties, the San Joaquin Light and Power system serves one of the most highly productive regions of California. Covering the floor of the valley are rich farming acres, the principal crops of which are grapes, peaches, figs, cotton, grain and dairy products. Along the southern and western rim, where the valley rises toward its encircling hills, are some of the world's finest oil fields. Mines, stock ranges, and lumber stands are further sources of production in the foothills and the Sierra Nevada.

Largest of the cities of the San Joaquin territory is Fresno, situated near the center of the system. Bakersfield, Merced, Madera, Selma, Sanger, Reedley, Kingsburg, Taft, Coalinga, Dinuba, Los Banos, Wasco, and Corcoran are among the other important communities which serve as processing and marketing centers for the valley.

In addition to this territory, the San Joaquin Light and Power Corporation supplies electricity to a coast territory of 1,848 square miles in Santa Barbara, San Luis Obispo, and Monterey Counties, through the Midland Counties Public Service Corporation, a subsidiary company to which it sells wholesale power. The principal towns served are San Luis Obispo, Santa Maria, Paso Robles, Atascadero and Pismo.

Service rendered by the San Joaquin company is largely agricultural. More than 1,035,785 acres of land are irrigated by electric pumps driven by San Joaquin Power, the pumping load totaling more than 191,000 horsepower. The high development of agricultural service in the San Joaquin Valley is one of the outstanding achievements of this company. The adaptation of electric transmission and distribution practices to the low cost required for service in an area which, including the towns of the valley, has a consumer density of only 11.40 consumers per mile of distribution line, is the result of engineering efficiencies and economies pioneered by this company.

Manufacturing and processing industries, largely activities developed in connection with valley agriculture, have a total electric motor installation of 90,226 horsepower served by the San Joaquin Power lines.

Oil field service has become an important activity of this company with the development of rich fields in the Bakersfield, Taft

and Coalinga areas of the valley during the last few years. Oil field motors totaling 16,177 horsepower are served by the company.

A total connected load of 539,028 horsepower is served by the San Joaquin Light and Power Corporation. In 1929 this company supplied 662,155,305 kilowatt-hours to 82,109 consumers.

Gas is served by the San Joaquin Light and Power Corporation in Bakersfield, Selma and Merced. Bakersfield and Selma are connected with natural gas, and plans are now making to change Merced over from artificial to natural gas. During the past year approximately 1,110,000,000 cubic feet of gas was furnished in these three communities to 11,607 consumers. A total of 212.71 miles of main are used in the three systems.

In addition to electrical and gas properties, this company controls the Bakersfield and Kern Electric Railway, serving the city of Bakersfield; and the Valley Electrical Supply Company, a merchandising company for electrical appliances, operating in Fresno and Bakersfield.

Service facilities of the San Joaquin Light and Power Corporation represent an investment of more than \$76,000,000. During 1929 capital expenditures aggregated approximately \$3,200,000, and the construction budget for 1930 was \$6,226,000.

This company's annual report, presented to its stockholders in March of this year, showed that during 1929 gross operating revenues amounted to \$11,336,743.66, as against \$10,409,804.67 for 1928, an increase of 8.90 per cent. Operating expenses, maintenance and taxes amounted to \$4,887,122.59, an increase of 9.75 per cent. Net earnings from operation amounted to \$6,449,621.07, compared with the 1928 figure of \$5,956,866.21, an increase of 8.27 per cent. Appropriations for depreciation reserve totaled \$1,456,488.37.

*Midland Counties Public Service Corporation.* The origin and development of this corporation have already been described as well as the territory over which its operations extend. Its system consists of 12 substations, with a combined capacity of 41,150 k.v.a., 194 miles of 66,000-volt transmission lines, and an electric distribution system within the territory served. All power is purchased from the San Joaquin Light and Power Corporation.

# The Financial Side of "Pacific Service"

## EARNINGS

Following is a preliminary statement of the Company's income account for the six months ended June 30, 1930, compared with the corresponding period of the preceding year. This statement includes earnings of subsidiary companies only for the period subsequent to the date of their acquisition.

	6 MONTHS TO JUNE 30, 1930	
	Amount	Increase
Gross (including Miscellaneous Income).....	\$34,118,861	\$1,128,152
Maintenance, Operating Expenses, Taxes (including Federal Taxes), Rentals and Reserves for Casualties and Uncollectible Accounts.....	15,348,294	658,346*
Total Net Income.....	\$18,770,567	\$1,786,498
Bond Interest and Discount.....	5,352,824	94,336
Balance.....	\$13,417,743	\$1,692,162
Reserve for Depreciation.....	4,037,419	547,227
Surplus.....	\$ 9,380,324	\$1,144,935
Deduct Earnings of Subsidiary Companies prior to acquisition.....	88,692	88,692
Balance.....	\$ 9,291,632	\$1,056,243
Dividends Accrued on Preferred Stock.....	2,761,200	335,159
Balance.....	\$ 6,530,432	\$ 721,084
Dividends Accrued on Common Stock.....	4,082,947	1,100,044
Balance.....	\$ 2,447,485	\$ 378,960*

\*Decrease

The balance of \$6,530,432 available for dividends on common stock was equivalent to \$1.60 per share upon the average of 4,082,947 shares of common outstanding during the first half of 1930.

## WIDENING DISTRIBUTION OF COMPANY'S STOCK

The number of holders of the Company's stock continues to increase steadily. At June 30, 1930, the preferred stock was distributed among 40,463 investors, an increase of 9,957 within the year. This increase was due primarily to over-the-counter sales of 5½% preferred stock, of which \$6,776,000 was sold to 6,615 subscribers in the last twelve months.

The common stock is held by 26,039 investors, an increase of 7,479 since June, 1929. Inasmuch as no common stock was sold to the general public during this period, this increase of almost one-third in the number of common holders indicates the steadily widening distribution of this stock among investors through open market purchases.

Total stockholders of all classes aggregate 66,502, of whom 54,274, or 81.6%, are residents of California. In addition, the preferred stocks of the Great Western Power Company of California and San Joaquin Light and Power Corporation are held by 21,955 stockholders, of whom approximately 94% reside in this State. An aggregate of 88,457 investors thus participate in the ownership of the consolidated system.

The following summary indicates that women predominate numerically in the Company's stock registers:

	NUMBER	% OF TOTAL
Women stockholders.....	27,004	40.6%
Men.....	26,604	40.0%
Joint Tenants (usually husband and wife).....	10,927	16.4%
Corporations, Associations and Institutions.....	1,967	3.0%
Total.....	66,502	100.0%

The phenomenal increase in the number of women participating in corporate ownership in recent years is reflected in the fact that in 1914, prior to its inauguration of the "customer-ownership" plan, only 900 of the Company's stockholders were women, compared with upwards of 27,000 at the present time.

Employees of the Company hold \$4,287,000 par value of stock, which is distributed among 3,554 employees, or slightly in excess of one-half of the Company's regular operating personnel, exclusive of construction forces.

#### SALE OF \$25,000,000 FIRST AND REFUNDING MORTGAGE 4½% BONDS

In July, 1930, the Company sold to a syndicate headed by the National City Company \$25,000,000 par value of its First and Refunding Mortgage Series "F" 4½% Bonds dated June 1, 1930, and maturing June 1, 1960. These bonds, which were sold at a price to cost the Company 4.92%, met with an excellent reception, the issue being promptly oversubscribed. Substantial amounts were purchased by insurance companies and other investment institutions.

The proceeds of this issue will be utilized in financing the Company's large construction program, and to retire certain bond issues bearing a higher interest rate, with a resultant saving in annual fixed charges.

Construction expenditures of the past four years aggregating upwards of \$84,700,000 have been financed entirely from the sale of stock and from working capital, no bonds having been sold, except for refunding purposes, since April, 1926. As a result of the steadily increasing equity in physical properties back of the Company's bonds, the margin of earnings over interest charges during recent years has become steadily larger, as indicated by the following summary, which shows that net earnings available for fixed charges during the five years ended December 31, 1929, increased \$16,841,517, while interest chargeable to operation increased only \$3,587,037.

Calendar Years	Gross Earnings	Operating Expenses, Maintenance, Taxes and Rentals	Net Earnings	Interest Charged to Operation	Balance
1924.....	\$44,934,683	\$28,203,096	\$16,731,587	\$ 6,261,528	\$10,470,059
1925.....	48,066,897	28,898,712	19,168,185	7,078,183	12,090,002
1926.....	51,125,990	29,654,475	21,471,515	7,926,006	13,545,509
1927.....	58,395,812	30,596,845	27,798,967	10,472,974	17,325,993
1928.....	61,788,079	31,759,205	30,028,874	10,130,901	19,897,973
1929.....	64,820,894	31,247,790	33,573,104	9,848,565	23,724,539
Increase, 5 years. ....	\$19,886,211	\$ 3,044,694	\$16,841,517	\$ 3,587,037	\$13,254,480

# Pacific Service Magazine

PUBLISHED QUARTERLY IN THE INTERESTS OF

PACIFIC GAS AND ELECTRIC COMPANY

FREDERICK S. MYRTLE · EDITOR-IN-CHIEF

PACIFIC GAS AND ELECTRIC COMPANY

245 Market St., San Francisco

*The Pacific Gas and Electric Company desires to serve its patrons in the best possible manner. Any consumer not satisfied with his service will confer a favor upon the management by taking the matter up with the division headquarters.*

VOL. XVIII JULY, 1930 No. 1

It seems to have become an established policy of the National Electric Light Association to hold its great annual convention on the Pacific Coast at intervals of only a few years.

Taking the last two decades, for example, the convention was held in Seattle in 1912, in San Francisco in 1915, in Pasadena in 1920, in San Francisco in 1925 and again in this year of 1930. Furthermore, present indications point to a return in 1935.

Apart from the pleasure of a brief sojourn in a section of the country where the tired business man can obtain relief from the overpowering heat of the Atlantic Coast, there are cogent reasons why this Western rim of our great continent should attract the captains of industry whose lives are devoted to the study of electric power as an invaluable agent in the development of enterprise of all kinds, industrial, agricultural, commercial, to say nothing of its contribution to modern home comfort and economy.

The State of California holds pride of place as pioneer in more than one phase of the development of the electrical industry in this country. Among the pioneer achievements may be mentioned the first central station for the generation and distribution of electric light and energy throughout a city; the first successful experiments in rural electrification; the first electric transmission construction at high voltage; the plan of customer ownership that has since been adopted by all the great public utilities of the country. Today California leads all the states of the Union in production of hydro-electric energy, in percentage of homes wired for electricity, in electric farming. We have, then, much to show our friends from the other side of the Rockies and we are proud

to know that they evince a sufficient interest in us and our doings to make the journey across the continent every now and then for the purpose of exchanging ideas with us on matters of vital importance to progress and development in every section of the civilized world.

Consummation of the agreement between Pacific Gas and Electric Company and the North American Company of New York, full details of which were given to our readers in a previous issue, took place June 12th, through the necessary exchange of stock between the two principals to the transaction. Our company thereupon assumed control of all the North American Company's public utility holdings in the State of California, consisting of the Great Western Power Company, the San Joaquin Light and Power Corporation and the Midland Counties Public Service Corporation, with their subsidiaries.

The newly affiliated utilities, while preserving for the present, at least, their respective corporate entities, will henceforth be operated as subsidiaries of Pacific Gas and Electric Company. The new conditions will of necessity bring about a partial readjustment of the "Pacific Service" working organization. Meanwhile, as a result of the merger, certain changes have been made in the boards of directors and officers of each of the utilities concerned.

At a recent meeting of our company's Board of Directors, Messrs. Edwin Gruhl and James B. Black, both vice-presidents of the North American Company, which now becomes our company's largest individual stockholder, were elected to positions on the Board, as was also Mr. Guy C. Earl, former president of the Great Western Power Company. Mr. A. Emory Wishon, former vice-president and general manager of both the Great Western Power Company and the San Joaquin Light and Power Corporation, was elected a management officer of Pacific Gas and Electric Company with the title of vice-president and assistant general manager. Following are the new official set-ups of the other utilities:

Mr. A. F. Hockenbeamer succeeds Mr. Guy C. Earl as president of the Great Western Power Company. Mr. P. M. Downing becomes vice-president and general manager; Mr. A. Emory Wishon, vice-president and assistant general manager. Mr. James B.

Black, representing the New York interests, becomes a vice-president. Mr. D. H. Foote becomes secretary and treasurer; Mr. E. W. Hodges, comptroller. The new Board of Directors consists of the following: A. F. Hockenbeamer, Frank B. Anderson, Allen L. Chickering, A. Emory Wishon, P. M. Downing, D. H. Foote, T. J. Straub, C. O. G. Miller, Guy C. Earl, F. T. Elsey, A. G. Wishon, John P. Coghlan, Chas. L. Barrett. Executive Committee: A. F. Hockenbeamer, Allen L. Chickering, F. T. Elsey, Frank B. Anderson, Guy C. Earl, C. O. G. Miller.

In the San Joaquin Light and Power Corporation, Mr. A. Emory Wishon becomes the new president. Mr. A. F. Hockenbeamer takes the position of chairman of the Board, with Mr. A. G. Wishon, of Fresno, vice-chairman. Mr. E. P. Smith, of Fresno, becomes assistant to the president. Mr. P. M. Downing becomes vice-president, and Mr. W. E. Durfey, of Fresno, vice-president and assistant secretary and assistant treasurer. Mr. D. H. Foote becomes secretary and treasurer, and Mr. E. W. Hodges, comptroller. Directors: A. F. Hockenbeamer, C. O. G. Miller, Frank B. Anderson, F. T. Elsey, Allen L. Chickering, P. M. Downing, John P. Coghlan, D. H. Foote, Charles L. Barrett, Guy C. Earl, A. Emory Wishon, A. G. Wishon, E. P. Smith. Executive Committee: A. F. Hockenbeamer, Allen L. Chickering, F. T. Elsey, Frank B. Anderson, Guy C. Earl, C. O. G. Miller.

Messrs. Hockenbeamer, Miller, Anderson, Elsey, Chickering, Downing, Foote, A. Emory Wishon and A. G. Wishon constitute the new board of the Midland Counties Public Service Corporation. The same set of officers will handle the affairs of both the San Joaquin and Midland Counties organizations.

The much-talked-of business depression has not halted our company's business activities. Its payroll is larger than it was a year ago. In May, the last month for which reports are available, the company payroll was \$2,124,000, or \$520,000 more than for the corresponding month in 1929. The number of employees was 14,242, an increase of 3,761 over May, 1929. In this connection we quote from a statement issued to the public press by President A. F. Hockenbeamer:

"The payroll of this company for the year will run in excess of \$25,000,000, more than

\$2,000,000 a month for every month in the year. We have not halted in a single undertaking in our program of building for the future. We are going right along with our dam, power-houses and ditches on our Salt Springs project on the Mokelumne River, and there will be no let-up on this project until it is finished in 1931 or 1932. Work on our steam-electric plant in San Francisco is likewise moving ahead, with full crews at work, under orders to get the first of two large steam turbines ordered for that station into operation this fall. Our natural gas program is being carried on as laid out last year and the year before, and construction crews are now building into Napa, Sonoma and Marin Counties, which will be supplied with natural gas before the end of September. Extensions, gas and electric, are going ahead in every city and town where there is demand for them.

"California is too large and too rich a State to be permanently affected by any slowing up of business. Depressions here can never be more than temporary. Business will turn upward as quickly as it turned downward, and when it turns upward the Pacific Gas and Electric Company intends to be ready with additional facilities to take care of it. When the upswing comes there will be immediate demand for more power in shops and factories and for more natural gas as fuel in our industries. Our aim is to be prepared."

The figures given by President Hockenbeamer do not take in the recently affiliated companies, development work upon whose properties is likewise going ahead according to program.

"It is an axiom that the future growth and progress of a utility depend on the future growth and industrial progress of the towns or cities it serves," states the *Vallejo News*, in an editorial. "The utility has a fixed investment in plant and property. It cannot move elsewhere if business is poor. Consequently, it has a direct interest in community development.

"Particularly in the less-populated districts, the life of the utility and the life of the town become intertwined. Each progresses as the other progresses, and if one fails the other fails. Together, they are a triumphal pair of leaders in the march of industrial progress and payroll."

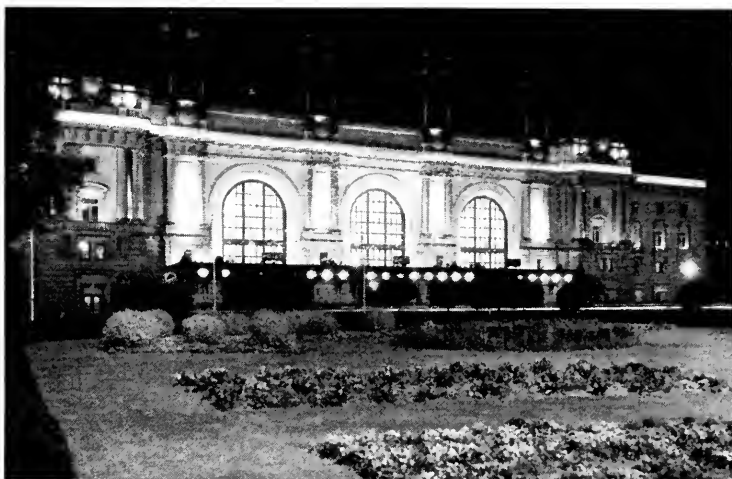
## Recollections of the N. E. L. A. Convention in San Francisco

San Francisco gave a true Western welcome to 4,000 delegates from various parts of the country who attended this, the fifty-third convention in the history of the N. E. L. A., held during the third week in June.

In the way of display, the night illumination feature was on a scale never before reached. Not only was Market Street

ablaze from end to end, but a spectacular feat was accomplished at the Civic Center on the opening night. From high-voltage transmission towers erected in the Civic Center park elaborate lighting apparatus was trained upon the park and surrounding buildings, taking in the City Hall, the State Building and the Civic Auditorium, which was the meeting place of the convention. At a given signal an airplane swooped down upon the scene and passed sufficiently near to the transmission towers to touch off the lighting apparatus by sound waves from its motor. In an instant night was turned into day. Another spectacular exhibit at the Civic Center was a 50,000-watt Mazda lamp, the largest ever made, operating at 120 volts.

Convention week was one of earnest deliberation relieved by entertainment. Among the great captains of industry who attended may be mentioned Messrs. Matthew S. Sloan, New York Edison Company, presiding officer of the convention; Owen D. Young, General Electric Company, world-famous economist and financier; Edward N. Hurley, former chairman of the U. S. Shipping Board; Merle Thorpe, of Washington, D. C., editor of *Nation's Business*; Martin



Night view of the Civic Auditorium during Convention Week.

J. Insull, Middle West Utilities Company, Chicago; Edwin Gruhl, North American Company, New York; W. A. Jones, Henry L. Doherty & Company, New York, elected at the convention president of the N. E. L. A. for the ensuing year; P. S. Arkwright, Georgia Power Company, Atlanta, chairman of the Public Policy Committee; J. F. Owens, Oklahoma Gas and Electric Company; A. W. Robertson, Westinghouse Electric and Manufacturing Company; M. E. Sampsell, Central Illinois Public Service Company, Chicago; Bernard F. Weadock, special counsel representing the utilities before the Federal Trade Commission. Each of these gentlemen, and many others not mentioned, had a telling message to deliver.

Space does not permit discussing the convention in detail. A few high spots, however, may be picked out. Mr. Sloan, for instance, attracted attention by his masterly review of the progress of the electrical industry during the past year. He told of a sum exceeding \$1,000,000,000 that will be required by the electrical utilities of the country during the present year for extensions of service in addition to the millions to be expended for operating purposes.

Mr. Merle Thorpe spoke on "Let There Be Light." His address sparkled with humor. He told how a famous United States Senator of the Middle West, in the course of a plea for government ownership, had promised reductions in the annual cost of service to domestic consumers of a considerably greater amount than their total annual bill. Mr. Thorpe spoke of interconnection as decentralizing industry and relieving congested areas, and he upheld the good faith of the public utilities through their record of continual reduction of rates in the face of increased operating costs, cost of material and mounting taxes. He deprecated the attitude of the professional political reformer and raised a laugh when he said that America's favorite indoor sport was to create super-men at the ballot box.

Mr. Edward H. Hurley presented the case for private versus government ownership and cited the record of the shipbuilding industry under government control during the war period. Mr. Edwin Gruhl presented to the convention some striking comparisons between the value of the electric dollar and that of other dollars, such as the clothes dollar, the food dollar, rent dollar, etc. He estimated the purchasing power of the present dollar for ordinary necessities of life at 58 cents, as compared with the dollar of 1914; while the electric dollar, he said, through a continuous policy of reduction in the price of the kilowatt-hour had a purchasing power of \$1.36, more than double the buying power of the 58-cent cost-of-living dollar. This comparison, said Mr. Gruhl, was based only on prices of electric energy; but, if the increased efficiency of household appliances



President M. S. Sloan.

were also to be taken into account "we would have to quadruple rather than double the size of the dollar bill."

Public Policy night, always a star feature of these conventions, proved of unusual interest this year. Chairman Arkwright's report commended progress under proper regulation and pledged the electrical industry to a policy of vigorous and constant research. Commenting upon the construction program for this year, involving, as stated by Mr. Sloan, a capital expenditure exceeding a billion dollars, the report pointed out that the total capital investment in the industry today stands at eleven billion dollars. The report estimated, also, that if the requirements of the nation during the next ten years are to be adequately met the output of electricity will have to be doubled by 1940.

Mr. Owen D. Young spoke at this session on the subject of "The Problem of Our American Surplus." His talk omitted all reference to any controversies now raging in the public utility field. It included the problem presented by the surplus production in agriculture, the raw material surplus outside the field of agriculture, the industrial surplus — more manufactured goods than the people can consume — the surplus of

business experience, technical knowledge and others which might be rendered serviceable to other nations without diminishing the home supply. In conclusion Mr. Owen said:

"When our political policy in international affairs becomes co-operative in spirit, which need not involve us in entanglements or alliances; when our economic policy looks to the economic development of the world as a whole and the improvements of living



Owen D. Young.

standards and consuming power of peoples everywhere; when our tariff and our treaties are made to evidence this spirit because we are under suspicion now, then we may hope for effective plans for farm relief, for reduction of our surplus of raw materials and manufactured goods, for relief of unemployment, and for what is most important of all, a better spirit of all nations toward us and toward each other."

At this Public Policy session a 34-word message from Mr. Arkwright to Mr. Sloan, who was seated upon the platform but a few feet away from him, was sent around the world by co-ordinated telephone and cable lines in  $5\frac{1}{2}$  minutes. The previous best record was one of 8 minutes, established in 1927. This feat was accomplished by the Postal Telegraph Cable Company and the distance traveled was approximately 25,000 miles.

At another general session radio was brought into play. Greetings were exchanged between the Convention in San Francisco and the World Power Conference in Berlin. President Sloan extended the greetings of the N. E. L. A., and Dr. Oskar von Miller, chairman of the Berlin Conference, responded. In addition, messages to the San Francisco Convention were received from The Earl of Derby, speaking from Aldershot, England; Senator Marconi, speaking from London; last, but by no means least, our one and only Thomas A. Edison, addressing San Francisco from his library in West Orange, N. J. This was a most interesting experience. It was arranged by the National Broadcasting Company and the American Telegraph and Telephone Company and was handled by the N. B. C. announcer from San Francisco.

Women played a not inconspicuous part in the convention. The Women's Commit-



The City Hall illuminated in honor of the Convention.

tee of the N. E. L. A. held a special session presided over by Miss Sara Harris, Utica Gas and Electric Company, N. Y. Mrs. Nyra Letchworth, of Fresno, chairman of the Pacific Coast Division, extended California's welcome and greetings to all the visiting delegates. Mrs. Ruth Creveling, San Diego, reported upon activities of the Women's Committee during the past year. There was a program of addresses to which Mr. Sloan and other delegates to the convention contributed. There was a large attendance.

As is usual in such instances, the local company had much to do with the arrangements. Mr. A. F. Hockenbeamer, as honorary chairman of the general convention committee; Mr. Paul M. Downing, chairman of the executive committee; Mr. A. H. Markwart, chairman of the construction and equipment committee; Mr. W. G. Vincent, Jr., chairman of the hotels committee; Mr. R. E. Fisher, chairman of the entertainment committee, all had their hands full during the entire week. Mr. Hockenbeamer radioed a message of greeting to the delegates aboard the special trains speeding westward across the continent.

Pacific Gas and Electric Company was further distinguished when Mr. Paul M. Downing was elected fourth vice-president of the N. E. L. A. Following the usual method of progression by seniority, this would appear to indicate that he will preside over the convention in 1935.

F. S. M.

# PACIFIC GAS AND ELECTRIC COMPANY

A CALIFORNIA CORPORATION

Managed by Californians

Operated by Californians

## THE CONSOLIDATED "PACIFIC SERVICE" SYSTEM REPRESENTS

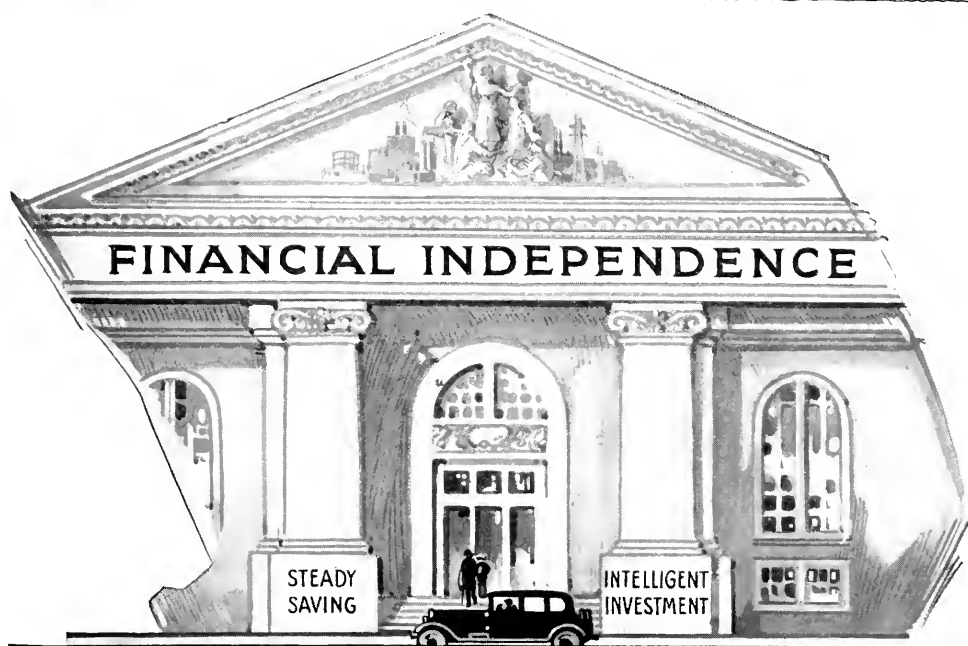
- 17,428 employed in all departments.
- \$600,000,000 capital invested in gas, electricity, street railway, steam and water plants.
- 85,000 square miles of territory in which it operates—an area greater than that of England and Wales.
- 85,000 stockholders.
- 45 counties of the State in which it transacts business.
- 1,223,981 consumers served with gas, electricity, water and steam.
- 2,700,000 people in 45 counties, which is approximately 50 per cent of the State population.
- 605 cities and towns in which it supplies service directly and through other companies.
- \$28,419,151 annual wages paid employees, year ending May 31, 1930.
- \$8,937,028 taxes, Federal, State, county and local, year ending May 31, 1930.
- 1,070,022 horsepower developed in 47 electric water-power plants.
- 402,835 horsepower developed in 16 electric steam plants.
- 1,472,857 total horsepower developed in 63 plants.
- 3,254,139,000 kw. hours sold, year ending May 31, 1930. This is equivalent to the effort of 10,847,000 men.
- 22,618,119,800 cubic feet of gas sold, year ending May 31, 1930.
- 25 gas plants.
- 31,322 miles of transmission and distribution lines. Greater than the distance around the earth.
- 6,546 miles of mains used in distributing gas. Greater than the distance between San Francisco and Oslo, Norway.
- 955 miles of mains and ditches used in distributing power.
- 1,370 miles of track of railway supplied with electric power.
- 616,395,950,000 gallons of water storage capacity of 115 lakes and reservoirs. This amount of water would supply the City of San Francisco at the present rate of consumption for approximately 34 years.
- 218,484 acres of land owned in California.
- 550 parcels of property owned in cities and towns.
- 2,899,131 barrels of California oil used, year ending May 31, 1930.
- 535,442 horsepower in agricultural motors depending on "Pacific Service."
- 1,284,020 horsepower in mining, electric railways, manufacturing and other motors depending on "Pacific Service."
- 17,261,600 incandescent lamps nightly lighted.
- 3,704,090 horsepower connected to system.

PACIFIC GAS AND ELECTRIC COMPANY

General Offices: 245 Market Street

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Branches in all principal cities and towns of 45 counties of North Central California.



# Financial Independence—

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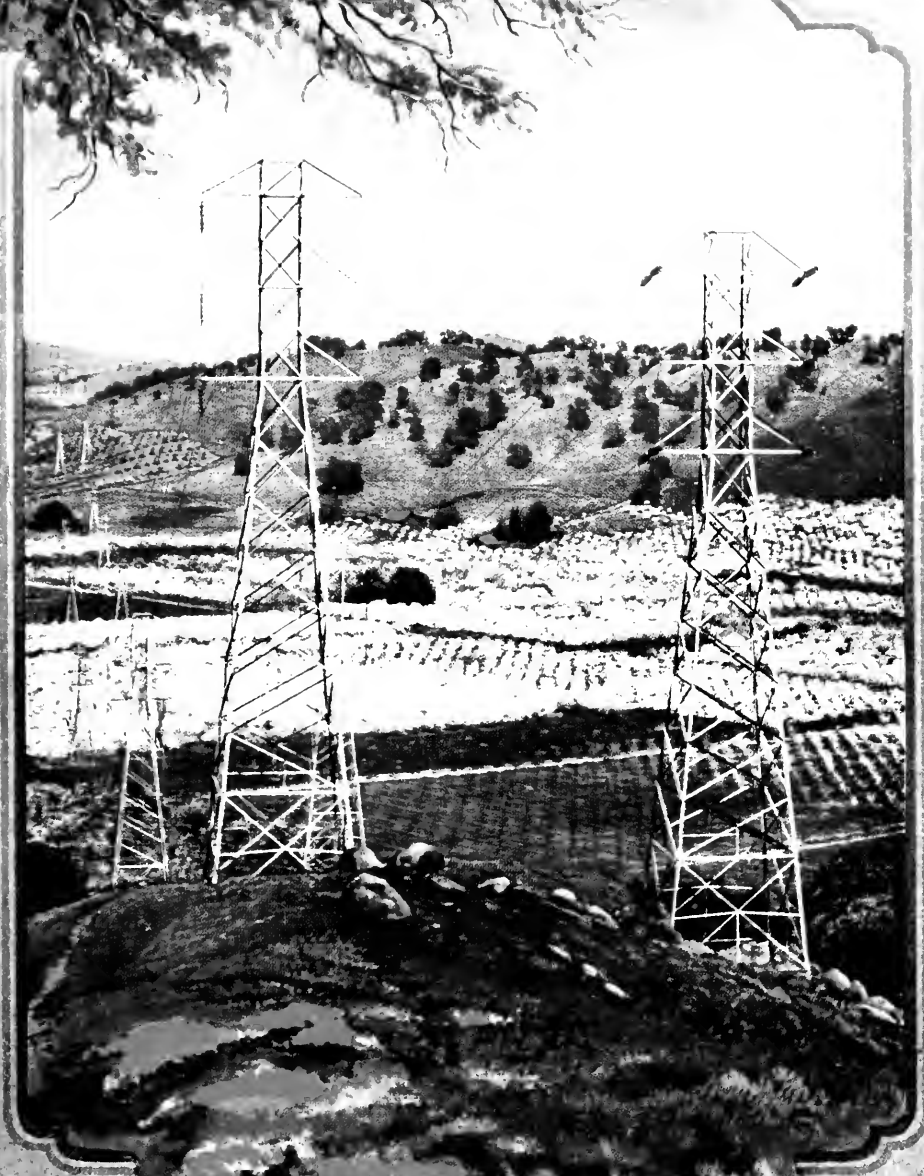
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*Stock Sales Department*

245 Market Street • San Francisco

# PACIFIC SERVICE MAGAZINE



"PACIFIC SERVICE" IN THE  
ORCHARD COUNTRY  
NEAR VACAVILLE

Vol  
18

OCTOBER 1930

No  
2

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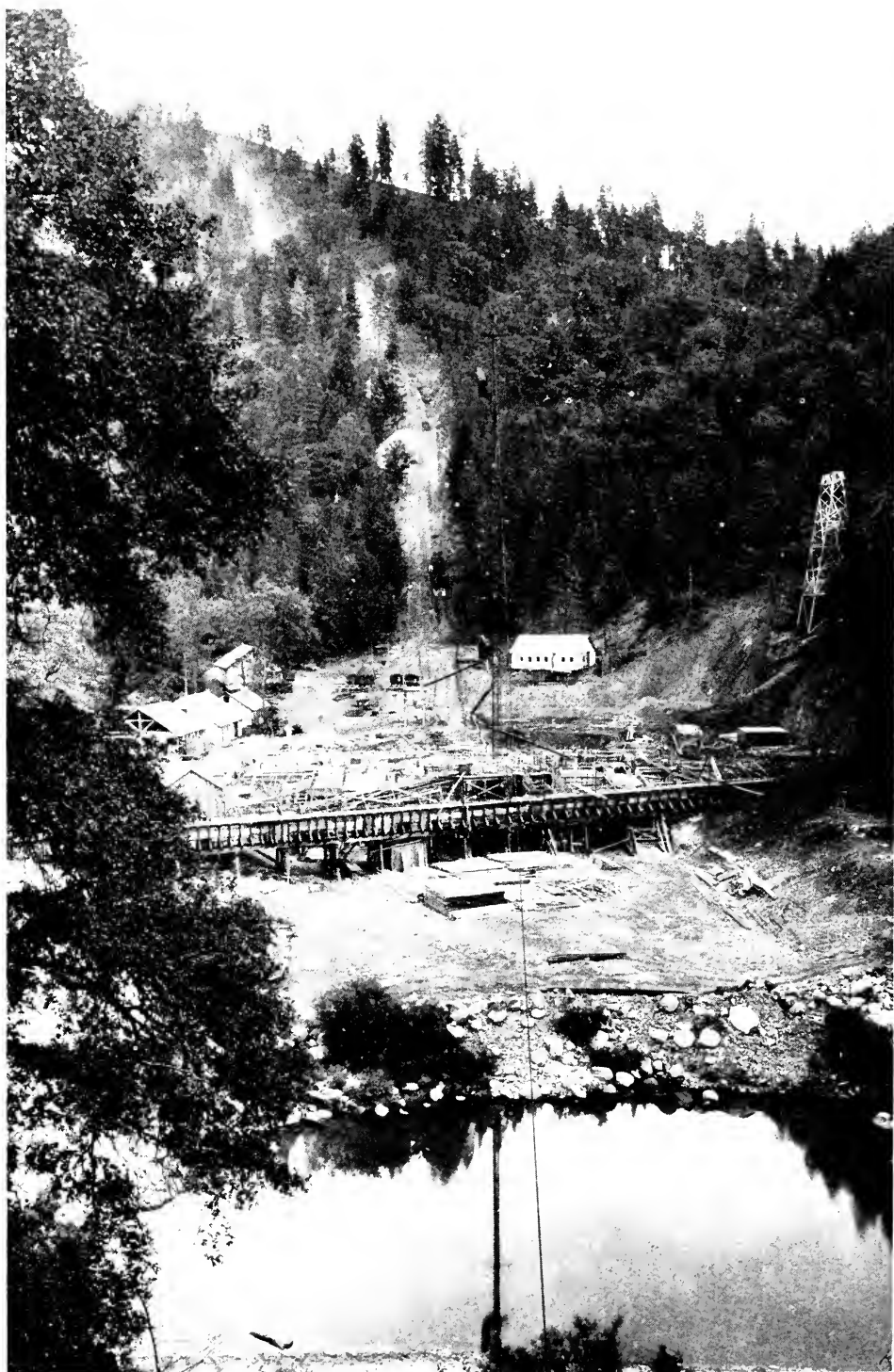
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Tiger Creek power plant site, Salt Springs—Mokelumne River development. Picture shows 1200-foot slope down which the penstock will be laid.

## *Salt Springs Water and Power Project on Way to Completion*

*Record of progress made on construction of dam, water-conduit,  
Salt Springs and Tiger Creek power-plants and  
power transmission system.*

By FREDERICK S. MYRTLE

In the upper reaches of the Mokelumne River, near the border of Alpine County and about fifty miles upstream from Electra, our company's Salt Springs water and power development is rapidly nearing completion. Following is the record of accomplishment to date:

The Salt Springs dam is three-quarters completed. An amount of 2,500,000 cubic yards of rock-fill is in place. Approximately

one-half of the reinforced-concrete covering is in place on the upstream and downstream faces. Completion is expected by the early spring of next year.

At the downstream exit of the tunnel through the north side of the dam, the foundation for Salt Springs power-house has been poured and the building is in process of construction. Completion is expected by the end of the present year; installation of machin-



Upstream face of Salt Springs dam, as it appeared at end of September, 1930.

ery and equipment, including one generating unit of, in round numbers, 15,000 horsepower capacity, by June 1, 1931.

About 6 miles of the 18-mile concrete flume which will convey the water released from Salt Springs along the north bank of the river to Tiger Creek power-house is completed and in place. Of the seven tunnels along the line of conduit all but the two longest have been finished and the process of boring the others is well under way. Tunneling work will be completed by the first of next year and the entire conduit will be ready for use by May 31st.

At Tiger Creek power-plant, the foundation for the power-house has been poured and the building will be finished this year. Pipe for the penstock to be laid down the 1200-foot slope to the power-house is being assembled at the forebay site on the hill-top. The plant, which will be of 80,000 horsepower generating capacity, to be ready for operation by the early summer of next year.

In the way of transmission, a 17-mile single-circuit tower line connecting South Springs power-house with Tiger Creek is practically finished. The towers are up and most of the wire has been strung. The 110-mile double-circuit line from Tiger Creek to Newark is under construction and will be completed by mid-summer of next year.

The foregoing record reveals the high spots of construction accomplishment on a project that was started in the early summer of 1926.

Much has been written in previous issues of PACIFIC SERVICE MAGAZINE concerning its general purpose and scope. It is, in effect, practically an extension and enlargement of the old hydro-electric power system on the Mokelumne River that was constructed by



Portion of downstream face of dam, with Salt Springs power-house under construction at left.

the Standard Electric Company of California, one of the predecessor companies of "Pacific Service," in the early part of the present century. The completion of this project will develop all of the economic power available on the Mokelumne River. Its starting point is marked by a huge rock-fill dam that spans the north fork of the Mokelumne in a gorge some six miles below old Salt Springs lake. There giant bluffs rise on either side and along the crest of the northern or Amador County ridge, some 3,000 feet above the stream, stretches the Alpine highway heading for Nevada. This dam, when completed, will tower 300 feet above the stream level, will measure 900 feet through at base and will have a crest length of 1,300 feet, making it the largest rock-fill dam in the world. It will impound 130,000 acre-feet of water storage, and this, supplemented by the natural flow of the stream and its tributaries, will be used for generation of power in new plants now in process of construction located, respectively, at Salt Springs, immediately below the dam, and at Tiger Creek, some 21 miles downstream at the head of the Upper Standard canal, which is the main source of water supply for the Electra system.

In addition, it is proposed to build a new reservoir on Bear River, on the Amador

ridge, at an elevation of about 2,000 feet above the Salt Springs dam. Bear River is the most productive tributary of the Mokelumne and the completion of this companion storage project will permit additional energy, to the extent of 33,333 horsepower, to be developed at Salt Springs power-house. Then, a site for an additional power-plant has been marked at West Point, on the stream below Tiger Creek, where the installation will be of 20,000 horsepower capacity. Last, it is proposed to reconstruct the Electra power-house and thereby enlarge its capacity from its present rating of 26,000 horsepower to one of 80,000 horsepower. Altogether, this gigantic project when brought to final completion is scheduled to contribute an aggregate of, in round numbers, 229,000 horsepower in installed capacity to the electric generating resources of "Pacific Service."

The 130,000 acre-feet of water storage estimated to be derived from the construction of Salt Springs dam will be augmented by the supply from the Blue Lakes system to the northeast, in Alpine County, which was the original source of water supply for the Electra system. There is a cluster of five reservoirs, including Upper and Lower Blue Lakes, Twin Lakes, Meadow Lake and Deer Valley reservoir, and their combined storage capacity is 28,038 acre-feet. They all discharge into the Mokelumne. Below Salt Springs there will be available a supply from two Bear River reservoirs. The present one, which is a part of the old Electra system, is of 6,712 acre-foot capacity, and the additional one to be constructed will be of 34,000 acre-foot capacity. The value of this immense water storage will be better understood when it is explained that it will not be in any way impaired, let alone exhausted, by its use for power purposes. For, when the water has done its work in turning the wheels of the string of power-houses reaching down to Electra, it will be available for use by lower appropriators and riparian owners for municipal, domestic, irrigation and other purposes.

Preliminary work on the project was begun in June, 1926. The company established



Quarry on north bank of river, showing massive rocks loosened by blast.

headquarters at Martell, terminus of the Amador Central railroad which connects at Ione with a branch of the Southern Pacific leaving the main line between Stockton and Sacramento at Galt. Machinery and supplies were transported from various sources by this railroad. At that time there was no available means of transportation from the dam site to the highway several thousand feet above. There was, however, a small road leaving the highway at a forest ranger's station some 37 miles out from Martell and where the elevation is 6,500 feet above sea level. The road plunged down the slope a distance of five miles to a ranch, and our company's engineers reconstructed it and carried it down to a point where the Bear River crosses on its way to join the Mokelumne, a drop of 3,000 feet from the highway. From that point the road was carried along the north bank of the river to the dam site. Distance from the highway, about 12 miles. It was found, however, that if construction work was to be carried on during

all seasons of the year a better road and one with an easier grade would be necessary. Accordingly, a new road was constructed, leaving the highway at Barton's, a point 20 miles out from Martell, winding down toward the river as far as the old Tiger Creek sawmill that was a part of the early Electra construction, and thence following the course of the river to join the first road at the Bear River crossing. This road is 30 miles in length, measuring from highway to dam site, of ample width and well constructed, with a surfacing of rock. It was finished by the winter of 1927 and ever since that time has rendered excellent service, undamaged by all the truck-hauling that is its daily duty to bear.

It is estimated that about \$600,000 has been expended on road-building in connection with the Salt Springs project. However, in view of the magnitude of the work the outlay is deemed well offset by the low cost of transportation per ton mile.

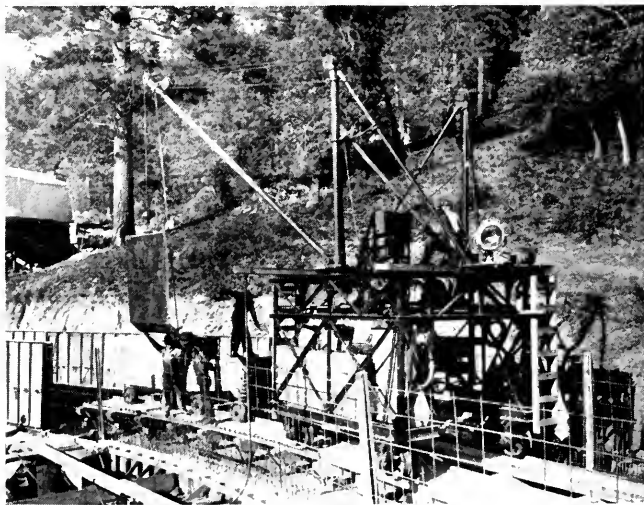
The transportation problem solved, an up-to-date construction camp was erected on Dead Man's Flat, on the south or Calaveras County side of the river, capable of housing 500 men and equipped with all proper accessories in the way of hospital, commissary, recreation hall,



Transmission line looking toward Salt Springs.

etc. Then work really started. The river bed was drained by means of a temporary diversion dam from which the water was carried past the main dam site through a 1200-foot tunnel driven under the north abutment, and when this had been accomplished the work of clearing the dam site and excavating the foundation began. Rock-pouring started in July, 1928. Rock was taken from quarries on either side of the stream, loaded into cars by electric shovels and carried along a little railroad to the dumping spot. Since that time there has been no let up, night or day.

Some engineering features may be of interest. The possibility of an economic power development depended largely upon the cost of storage at the Salt

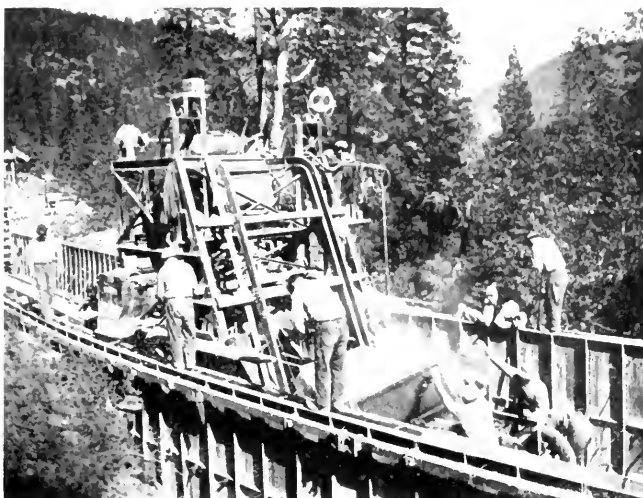


Machine setting up steel forms for sides of concrete bench flume.

Springs site. The rock-fill type of dam finally chosen appeared to be the structure best suited for this location. The chief factors favoring the selection were the abundance of excellent granite conveniently located for quarrying; the relatively low total tonnage (less than 20,000 tons) to be transported, and the fact that construction could be carried on, although at reduced speed during the winter months, throughout the entire year.

A concrete gravity dam at this site would have contained over 800,000 cubic yards of concrete, requiring the hauling of 152,000 tons of cement, or twenty times the tonnage of cement required to be hauled for the present structure. It has been estimated that a concrete structure at Salt Springs would have entailed an expenditure of approximately \$1,500,000 more than the cost of the rock-fill dam now nearing completion.

Due to the projected height of the structure great care was used in determining



Device for mixing and placing concrete in sides and bottom of flume.

conservative side slopes and to provide for settlement. The upstream face is designed with an average slope of 1.3 horizontal to 1 vertical and the downstream face with a slope of 1.4 horizontal to 1 vertical. With a top width of 15 feet these slopes give a base width, measured along the axis of the stream-bed, of 900 feet. The crest, which will be at an elevation of 3,958.5 feet above sea-level, has a total length of 1,300 feet. The dam will contain in all approximately 2,900,000 cubic yards of rock, of which 220,000 cubic yards will be required for a layer of derrick-placed rock of a uniform thickness of 15 feet against the upstream face. This, in turn, is being covered with a flexible reinforced-concrete facing one foot thick at the top and increasing to three feet at the bottom, at which point it ties into the concrete cut-off wall.

In plan, the dam is arched upstream, the magnitude of the warping, which is  $6\frac{1}{2}$  feet at the crest and decreases with the depth, being determined by the estimated settlement due to the weight of the fill combined with that due to water pressure, and the provision that the dam is to retain a slight convexity after final settlement has taken place. Tension cracks will thus be minimized in the concrete-facing. In addition, the design is such that a vertical section through the face of the dam parallel to the stream-bed will remain concave after settlement has taken place. Hence the lateral thrust due to the weight of the concrete will be against the

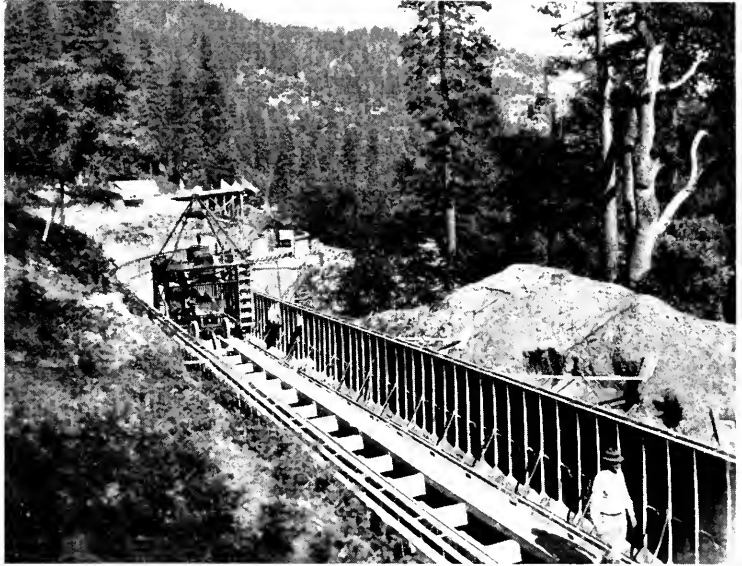


Machine for dismantling steel forms after use.

rock backing at all times and the tendency to buckling, which would result if the section became convex, is avoided.

To give sufficient flexibility, the concrete facing is divided into independent squares approximately 60 feet on a side. The edges of these slabs rest on concrete supports formed by filling depressions or grooves, purposely left in the face of the placed rock, with concrete. To simplify construction, the sides of the squares are straight lines, the four corners being accu-

rately set, using computed offsets from the theoretical slope line.



Section of flume, with steel forms in place.



Loading station where sand, gravel and cement are dumped into trailers for conveyance to mixing and placing machine.

In the vertical planes the grooves are rectangular in section, 4 feet wide and  $2\frac{1}{2}$  feet deep; in the horizontal planes the recesses are triangular in shape, the vertical or back face having a minimum height of 3 feet and the flat or horizontal face a minimum width of 4 feet. The triangular shape, selected for convenience in construction and for greater safety to men working below, incidentally forms a convenient walkway across the face of the dam and an excellent support for track from which to pour the concrete facing. The exterior surface of concrete filling the grooves is painted with hot asphalt before the slabs are poured, as is, also, the upper edge of each slab before the next one above is placed. The vertical edges of the squares are separated one inch and the space filled with an asphalt compound to provide a take-up for the shortening of face resulting from settlement of the rock-fill.

Two layers of one-inch steel bars at 9-inch centers are used to reinforce the lowest portion of the facing. The amount of reinforcing is

gradually reduced to a single layer of one-inch square bars at the crest of the dam spaced one foot one inch in both directions. The joints between panels are made watertight by means of soft copper seals embedded in the concrete. A concrete mix designed for maximum density, using five sacks of cement per cubic yard, gives a 28-day strength of approximately 3,000 pounds per square inch.

The cut-off is a concrete wall six feet thick extending from the base of the dam 6 to 20 feet into good rock. Where the height of the dam exceeds 200 feet, grout holes of two inches diameter, 50 feet deep and spaced six feet apart, were drilled along the bottom of the cut-off trench. At the two banks, where the height of the dam is less than 200 feet, the grout holes are spaced at 10-foot centers and the depth is gradually reduced to a minimum of 25 feet at the top of the dam.

The entire base of the derrick-placed rock section is laid up in concrete mortar to a height of 10 feet to give a more gradual transition from the solid bedrock to the loose fill. This is calculated to minimize the tendency of the concrete slab to crack along the line of junction of the facing and the cut-off wall.

Building the 15-foot layer of derrick-



Tractor and train passing under highway crossing near Bear River.

placed material containing a total of 220,000 cubic yards consists essentially of laying down large rock with the best possible contact to the adjacent rocks and of filling the intervening spaces with spalls and small stones. Electrically operated cranes, converted from full-swing power shovels mounted on crawler tracks with 35 to 40-foot booms and a front drum attachment, transfer rock from the loose fill to the placed section. Rock up to a maximum size of ten tons is handled by means of wire rope slings.

Each crane unit moves ahead a distance of 200 to 300 feet on a roughly leveled roadway on the top of the course being laid. On its return trip a second course is laid above the roadway, using spalls removed from the road bed to chink up spaces in the placed rock. Each of these courses is full width and 6 feet in depth, making a 12-foot lift constructed from each road level.

Each crane, working two shifts with a crew of six men, places approximately 3,000 cubic yards a month, 15,000 cubic yards per month for the five units to be used ultimately. Two units only were used in the beginning, increasing in number as the total length of roadway became greater.

An interval of several months elapses be-



Section of completed flume.

tween the dumping of the loose fill and the building of the placed rock against its slope.

For the work of concrete-facing a crushing and concreting plant was constructed on the left bank upstream from the spillway. Rock is quarried and crushed up to  $2\frac{1}{2}$  inch maximum size. Sand is obtained by passing crushed rock through a cone crusher.

Concrete is delivered along the face by 2-cubic-yard side-discharge cars hauled by a gasoline locomotive over a track constructed along the horizontal recesses of the placed rock. From the cars it is spouted by means of chutes directly into the cut-off wall and the 60-foot panels.

For more than a year past construction gangs have been at work upon the conduit by which water from Salt Springs will be conveyed downstream to Tiger Creek powerhouse. This will be approximately  $21\frac{1}{2}$  miles in length and of this  $18\frac{3}{4}$  miles will be concrete flume, box-like in structure, and laid upon a prepared bench excavated from the mountain side.

This flume will be 14 feet wide and 7 feet



Drill carriage for tunnel-boring.

deep (inside dimensions), giving it a carrying capacity of 550 cubic feet per second. The method used in its construction is worth more than passing mention.

The bench upon which the flume rests is constructed in much the same manner as any California mountain highway, the excavating being done by means of small power shovels mounted upon caterpillar treads, a familiar type of equipment in common use for such purposes. These shovels are the vanguard of an organization of crews and equipment which moves steadily along the mountain side. Following in the wake of the shovels are small crews installing drainage lines to protect the bench from erosion by the melting snows and finishing and trimming the surface to exact grade. Working in conjunction with the finishers is a 10-ton steam roller which compacts the materials to a firm, smooth surface.

When the bench has been prepared, concrete ties or sills are placed transversely at intervals of 4 feet 6 inches. These serve as a foundation on which the forms and reinforcing steel for the flume rest, and, also, as supports for a tempo-



Mucking machine eliminates hand-shoveling in tunnel excavation.

rary timber runway over which materials and equipment are transported until the flume bottom has been completed and attained adequate strength itself to support the weight of the equipment. After the concrete ties have been poured and their forms stripped, the bench is cleaned off so as to leave an even compact bearing surface upon which to pour the flume structure. The reinforcing steel for the floor and side walls is then placed in position, the floor and wall bars being wired together as a self-supporting unit resting upon the concrete ties. When completed this skeleton framework of steel bars has much the appearance of a heavy wire fence.

Following the installation of reinforcing steel, the temporary timber runway is placed, built of heavy timber cross-ties covered with planking, all of which is supported upon wooden blocks which rest upon the concrete ties previously described. This runway also carries steel rails along its outer edges, on which the heavy pieces of equipment travel which are used in setting the forms and placing the concrete. Outside and inside forms for the side walls consist of steel panels 5 feet in width and weighing approximately 1,000 pounds to the set. They are designed for erection on the concrete ties and, being readily removable, are re-used repeatedly on successive sections of the work.



Excavating foundation at regulator dam site.  
Concrete plant at right.

For the placing and stripping of forms and pouring of concrete, unique designs of equipment have been employed, consisting of four so-called "jumbos," one of which is

used to set the forms, a second to place the concrete, a third to strip the forms from the finished concrete, and a fourth to hoist and turn the tractors which haul materials to the concrete mixer. These four "jumbos" constitute a single concreting plant of which there are a total of four being used along the canal. Each "jumbo" is in reality a rectangular shaped steel tower about 15 feet high, the four legs of which



Tiger Creek gully where regulator dam is in process of construction. Buildings on upper bank mark the outlet of tunnel.

are mounted on flanged wheels which travel on rails on the timber runway. These towers carry various mechanical devices, depending upon the purposes which they are to serve. All of the "jumbos" are electrically operated and, with the exception of those used for stripping forms, they are self-propelled.

The form-setting "jumbo," which is the first unit of each concreting plant, carries a derrick mounted centrally on each side which is used to lift the heavy steel form panels into place. The concrete "jumbo" carries a complete self-contained concrete-mixing plant, including loading hopper, mixer, endless conveyor belts, chutes and distributing hoppers which permit an efficient handling of

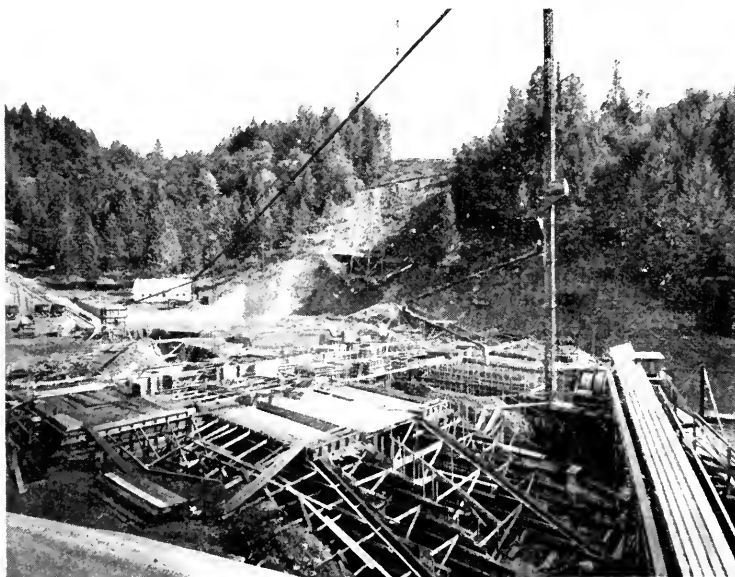
the materials from the raw aggregates through the process of mixing and distributing the concrete in the walls and floor of the flume.

Concrete materials for the construction of the flume are distributed from four aggregate bins set up on the bench so as to

straddle the flume at positions located conveniently to the highway and give the most economical hauling conditions. The hauling along the flume bench is done by means of small pneumatic-tired dump-cars pulled by industrial tractors. As these tractors and trailers travel along the flume bottom transporting the raw materials to the concrete "jumbo," they look for all the world like one of those little Fageol expresses



Old diversion dam at head of Upper Standard Canal.



Tiger Creek power-house site.

that were a unique feature of passenger transportation at the Panama-Pacific Exposition in San Francisco in 1915.

When the train reaches the concrete-placing machine, the tractor is cut loose and runs through the mixer "jumbo" and underneath the tractor-hoisting "jumbo," where it is picked up, turned about and left suspended in the air. Each successive trailer is cut loose at the mixing "jumbo" and its load dumped into the hopper. When the hopper is in the air the empty trailer is shoved ahead through the mixing "jumbo" and beyond the tractor-hoisting "jumbo." When the entire load of the train has been dumped and the empty trailers have been shoved ahead, they are again connected, and the tractor is lowered in front of the train ready to proceed back to the aggregate bins.

Along the line of conduit are encountered a number of bluffs which stretch out into the stream. It has been deemed advisable to bore tunnels through these rather than carry the flume around them. Three are of considerable magnitude. The first is Amador Bald Rock, a short distance below the Salt

Springs construction camp. The tunnel through this is 1,450 feet in length. Another mountain ridge, over which the road to the Alpine highway winds, is being pierced by a 9,150-foot tunnel, at the outlet of which the water supply will be augmented by the flow from Panther Creek, which joins the Mokelumne at that point. Then, at the lower end of the conduit there is encountered a bluff called Doak's Ridge, through which is being bored a 2,800-foot tunnel whose outlet overlooks a gully through which Tiger Creek flows on its way to the Mokelumne.

Four tunnels, one 380, two 180 and one 140 feet in length, penetrate smaller bluffs in the way.

All but the two longest tunnels are already bored. At the time of writing there is left a stretch of 1,200 feet in the Panther Creek and one of 2,000 feet in the Doak's Ridge bluff to be completed. All of this tunnel work is due to be finished by the first of next year.

There are, also, a number of ravines to be crossed. At two places on the line, Bear River and Alder Gulch, single-span arch



Construction camp at Tiger Creek. Standard canal flume in foreground.

crossings have been resorted to. Over deeper canyons, such as West Panther Creek and Deer Creek, the water is carried by inverted siphons. At smaller irregularities on the way the concrete flume is laid upon elevated piers.

At the lower portal of the Doak's Ridge tunnel the water will be diverted by means of a regulator dam, of the slab and buttress type, 100 feet in height, into a concrete flume which will convey the water a distance of about  $2\frac{1}{2}$  miles across the ridge to the summit, where there will be constructed a regulating forebay. This point marks the head of the penstock which will carry the water down the 1,200-foot slope to turn the wheels of Tiger Creek power-house.

Work at the Tiger Creek power-house end of the construction line started in January this year. A construction camp was erected and a crew of 75 men put to work clearing the site. In the early summer the work of excavating the foundation for the power-house started and, as already stated, this has been accomplished and the building is in process of construction.

The power-house site is located upon a flat bordering the stream and a short distance below the old dam which was constructed in the original Electra development to divert the water into the Upper Standard canal. From that point it follows the course of the river a distance of about 20 miles to the Petty reservoir, on the top of a bluff overlooking Electra.

There will be an afterbay below Tiger Creek which will regulate the flow into the West Point conduit which will feed a plant to be located five miles downstream, the site for the West Point power-plant. This, however, is not yet under construction. Temporarily, and until the commencement of work



Sand-blasting and painting interior of penstock pipe at Martell.

on the West Point plant, the afterbay dam will divert water into the Upper Standard canal whence it will flow to Electra.

For purposes of transportation our company has constructed a road into Tiger Creek which takes off from the Alpine highway at a point about one mile below Barton's. It is three miles in length and from the top of the bluff overlooking the Mokelumne an excellent view is obtained of the Upper Standard canal and the transmission tower line running down to Electra.

The magnitude of the work now being undertaken has necessitated dividing the territory into two construction divisions. The Tiger Creek division extends from the power-house to the Bear River crossing, and Superintendent George M. Wehrle has, at the present time, a force of 978 men in his employ. Six construction camps are scattered along the route. One is at power-house headquarters, another a penstock and forebay camp at the top of the hill, and another at Tiger Creek sawmill. Others are flume construction camps. Tiger Creek sawmill was abandoned twenty years ago but is now once more in requisition and is turning out an average of 25,000 feet of lumber a day for construction purposes.

The territory from Bear River to the dam site constitutes the Salt Springs division, with P. I. Kurtz as superintendent. At the

present time he has 750 men in his employ, 500 at the dam and 100 at each of two camps below. So that, altogether, there are 1,728 men at work on the construction job.

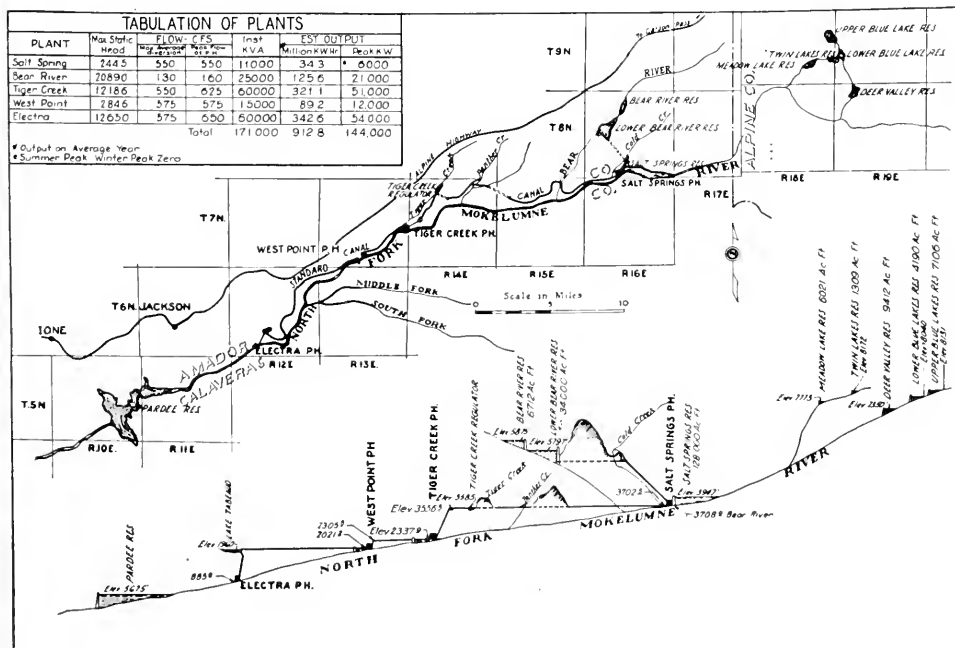
Martell, although no longer main headquarters, still presents a busy scene. All freight comes in there by the railroad from Galt, averaging 350 tons a day or 10,000 tons in a month. Freight consists of cement, reinforcing steel, power-house machinery, pipe, food supplies, powder, commissary, etc. At Martell, also, the work of sand-blasting and painting the interior of the penstock pipe is in process. As soon as each section is completed it is transported to Doak's Ridge.

The company's Department of Engineering, in charge of Vice-President A. H. Markwart, is responsible for the main engineering features of the work. The civil engineering designs were prepared under the direction of Mr. I. C. Steele, Chief of the Division of Civil Engineering, and his assistant, Mr. Walter Dreyer, in collaboration with Mr. J. D. Galloway of San Francisco as consulting engineer on the Salt Springs dam. The electrical engineering designs were made under the direction of Mr. J. P. Jollyerman, Chief of the Division of Hydroelec-

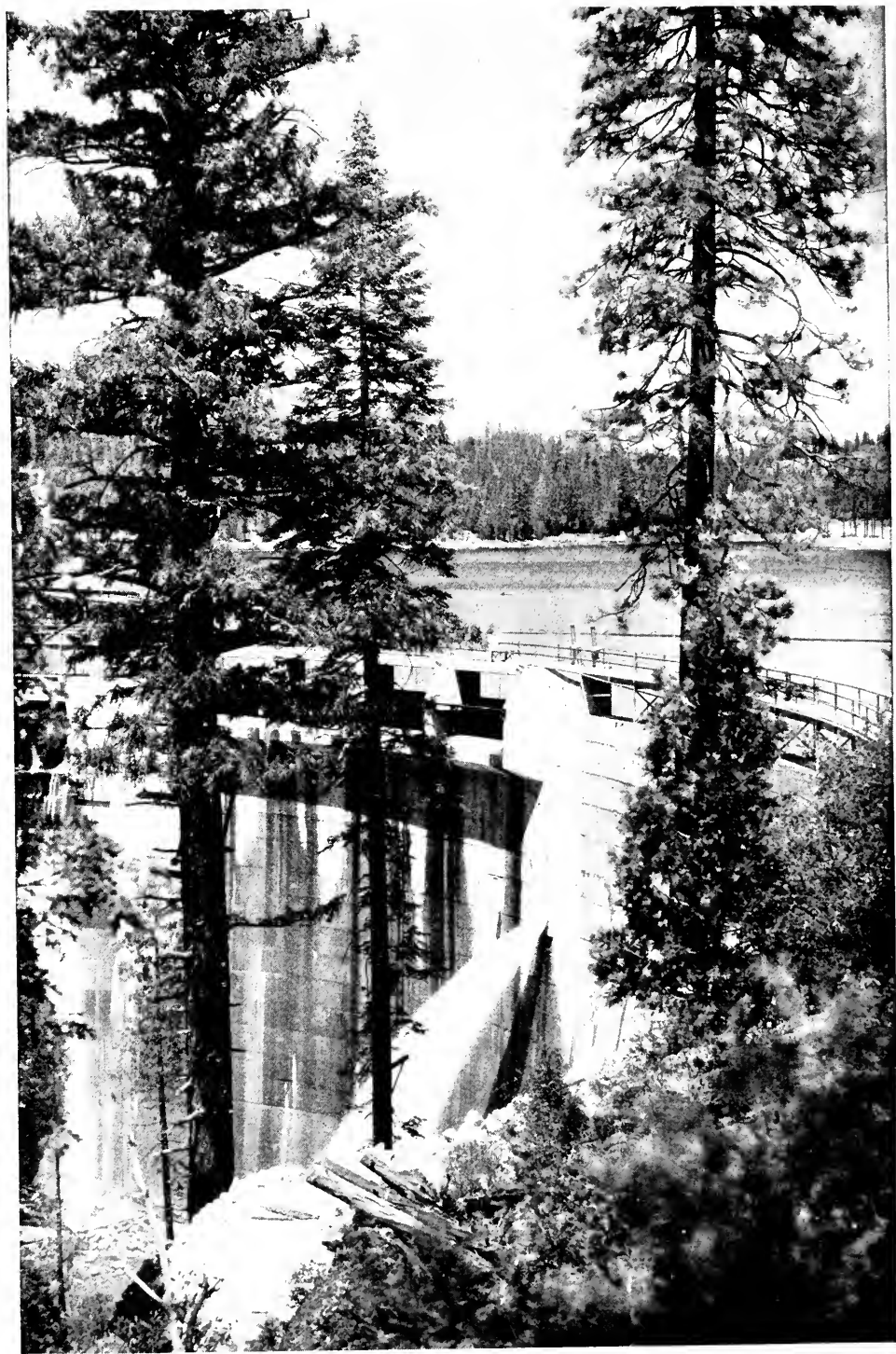
tric and Transmission Engineering, and his assistant, Mr. Earle Crellin. Mr. Grover C. Green is field engineer, with headquarters at Jackson.

All construction work is carried on by the General Construction Department under Mr. O. W. Peterson as construction engineer, assisted by Mr. Hector Keesling. Mr. R. D. Reeve is resident construction engineer.

It is confidently expected that by the early summer of next year enough water will be stored in Salt Springs reservoir to permit of the generation of power at Salt Springs and Tiger Creek and its transmission down country to our company's high-tension distributing station at Newark, there to be poured into what may be termed the "Pacific Service" power pool. This will be only a starter, for the entire development will not be completed until the two Bear River reservoirs contribute their quota of water and power and West Point power-plant is in operation. However, a great engineering feat, marked for its thoroughness as well as speed of execution, will have been accomplished when the first kilowatt of electric energy hums along the wires from Salt Springs.



Plan and profile map of Salt Springs Water and Power Development.



The new 110-ft. concrete dam at Lyons Reservoir.

# Old Lyons Reservoir Enlarged by Modern Concrete Arch Dam

An interesting piece of engineering work to the common advantage of the power and agricultural interests in a historical section of our "Pacific Service" territory has recently been completed in construction of a new dam at Lyons reservoir, on the south fork of the Stanislaus River.

Lyons is one of a number of artificial lakes located at various points in the Tuolumne County mountains, northeast of Sonora, which constitute the main sources of water supply for the hydro-electric system of the Sierra and San Francisco Power Company, a system now controlled and operated by Pacific Gas and Electric Company. The two most important of these are Relief and Lower Strawberry reservoirs, situated in the heart of the Stanislaus National Forest. The farthest away is Relief, lying on a creek of that name which is a tributary of the middle fork of the Stanislaus River. It nestles among rocky peaks 7,340 feet above sea-level, within ten miles of the summit of the Sierra Nevada mountains, that summit which is crossed by the Sonora Pass on the old Mono highway. The reservoir has a storage capacity of 15,122 acre-feet and the water released therefrom passes into Relief Creek and thence into the middle fork of the Stanislaus. Traveling in a southwesterly direction it flows past the recently constructed Spring Gap power-house at Baker's crossing

and on to Sand Bar dam, where it is diverted into a flume by which it is conveyed approximately sixteen miles to Stanislaus forebay, for the operation of Stanislaus power-house on the bank of the river 1,500 feet below.

Lower Strawberry is located about 30 miles below Relief, on the south fork of the Stanislaus. It is well known as a popular summer resort, several private homes being located on its shores. It lies 5,600 feet above sea-level and has a storage capacity of 17,900 acre-feet. The water released therefrom travels downstream a distance of three miles, where it is picked up by the Philadelphia ditch and carried over the divide between the south and middle forks of the Stanislaus to operate Spring Gap power-house at Baker's crossing and augment the natural flow of the middle fork downstream to Sand Bar.

Lyons reservoir was first constructed in 1898. It is located on Lyons Flat, about 20 miles northeast of Sonora, 4,200 feet above sea-level. It supplies water for the operation of Phoenix power-plant, fifteen miles below, and for the adjacent Phoenix reservoir, a picturesque stretch of water of about 1,215 acre-feet capacity occupying an elevation five miles northeast of Sonora. From Phoenix reservoir the old mining districts of Sonora, Jamestown and Columbia, respectively, are supplied with water for irrigation and mining as well as for domestic purposes.

The amount of stored water allocated to domestic and irrigation uses below Lyons dam is placed at 5,200 acre-feet. Before the recent reconstruction work the reservoir's storage capacity was only 839 acre-feet, so to provide the necessary supply about 4,360 acre-feet was drawn out annually from Lower Strawberry. By the construction of the new dam the storage capacity of Lyons has been raised to 5,500 acre-feet, so that



Old Lyons Reservoir, constructed in 1898.



Timber-crib dam at Lyons reservoir, now replaced by concrete structure.

there is now provided the total storage required. Lower Strawberry reservoir, thus relieved, is in a position to contribute an additional 4,360 acre-feet of storage to the middle fork of the Stanislaus by way of Philadelphia ditch previously referred to.

The new structure is what is known as a variable radius, concrete arch dam. It is 110 feet high and has a crest elevation of 4,220 feet above sea-level. It is constructed a few hundred feet downstream from the old dam, which was of timber crib construction, 52 feet in height. The entire foundation is of granite rock. Provision has been made for spilling flood waters over the dam into a water cushion formed by the construction of a secondary arch dam about 15 feet high and located about 80 feet downstream from the main structure. In order to confine the major spillway discharge to the center of the river channel and directly into the stilling pool, about 80 feet of the 400-foot spillway crest is depressed near the center of the dam and provided with four radio gates, 6 feet high by 20 feet long. With the gates open the spillway can discharge about 310 cubic feet of water per second per square mile of drainage area, as compared to the maximum recorded flood of 30 second-feet per square mile. The drainage area above the dam is 67.8 square miles, 72 per cent of which lies above an elevation of 5,000 feet above sea-level. About 7 per cent lies above 9,000 feet elevation. The area in general is well covered by forest.

Construction work started July 1, 1929. Storage of water began May 25, 1930, and the reservoir was first filled on June 18, 1930.

Considerable historical interest is attached to this section of California, in which water-

storage construction dates back from the earliest times. Tuolumne County Water Company was organized in 1852 to supply the water requirements of the mining area in the vicinity of Columbia, Sonora, Jamestown and Tuolumne. It acquired independent canals and water rights within that area and built up a comprehensive network of ditches and small regulating reservoirs that developed into the present Tuolumne water system. Through the main Tuolumne ditch water was diverted from the south fork of the Stanislaus at a point about 4,200 feet above sea-level, near the lower end of Lyons Flat, and this supply was augmented by releases from storage in four reservoirs in the high mountains at elevations between 5,300 and 7,500 feet that were constructed by the company in 1856. For years about 60 per cent of this water was dropped from the main canal through an unused head of about 1,000 feet to supply a system of ditches heading in or below Phoenix Lake on Sullivan Creek.

In 1898 the company was reorganized as the Tuolumne Water and Electric Power Company and the new concern built a reservoir at Lyons Flat to provide more perfect control and regulation of stream-flow, at the same time starting construction of the Phoenix power-plant to utilize the available water through a power head of 930 feet between the main ditch and a branch of Sullivan Creek above Phoenix reservoir. The dam creating the new reservoir was called Lyons dam. It rendered service for over 30 years as an integral part of the Tuolumne water system and until its replacement was necessitated by present-day requirements for greater stability and a more complete and beneficial use of available water resources.

# Reconstruction of Station "A"— First of New Turbines Installed

By C. H. DELANY, Assistant Engineer of Operation

Reconstruction work in progress at Station "A," our company's central steam-electric generating plant at the Potrero, in San Francisco, has reached the point where the first of four new turbo-generators, each of 50,000 k.v.a. capacity, that will constitute the ultimate new generating equipment is now in place and a second one is in process of installation.

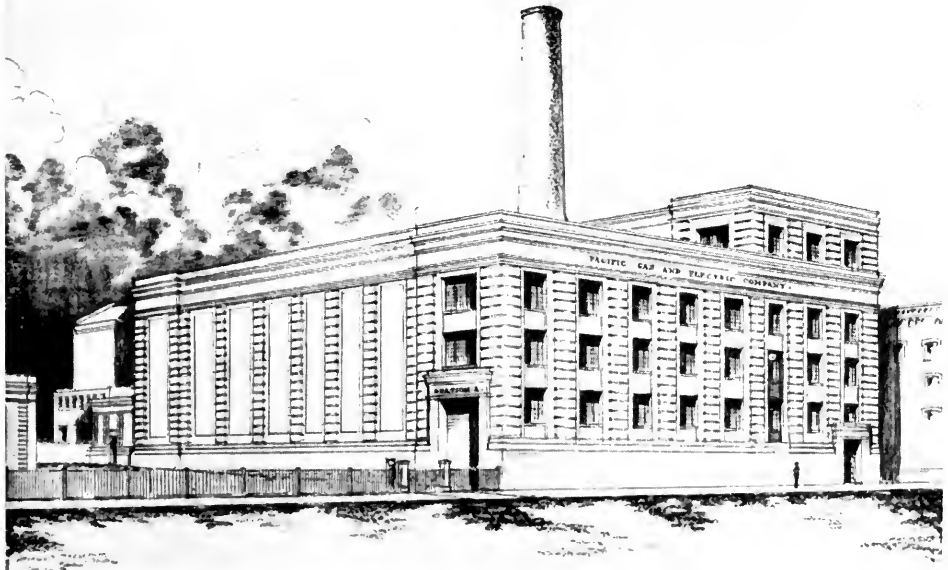
The complete plan calls for an increase of the electric generating capacity of the station from its previous rating of 85,000 horsepower to one of around 300,000. In addition, the building at Station "A," which has done service a great many years, is being practically reconstructed, with important extensions. All will be of the most modern construction. Natural gas will be used as fuel.

In the following article Mr. Delany deals with striking features of equipment design and operation. (Ed.)

In the year 1901 there was built in the Potrero District in San Francisco what was then a modern steam-electric generating station. This station was equipped with fifteen water-tube boilers and six vertical compound steam engines driving electric generators. The engine room was an immense room 425 feet long by 57 feet wide. The boiler room was built high enough to install coal bunkers

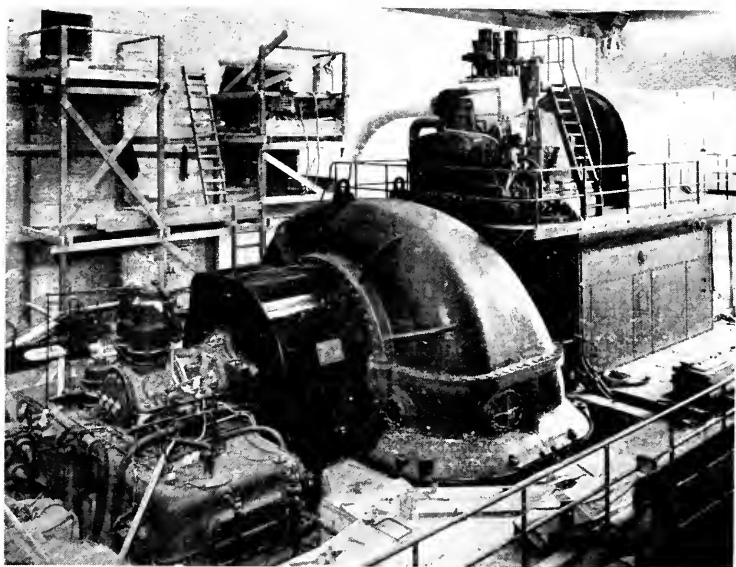
above the boilers, but these were never installed because, before the station was finished, oil became the cheapest fuel on the Pacific Coast.

This station a year or two later was acquired by the San Francisco Gas and Electric Company which was later absorbed by the Pacific Gas and Electric Company, and ever since then has been known as Station "A."



Architect's view of Station "A," San Francisco, reconstructed.

The station was built for a working steam pressure of 200 lbs., which was the highest pressure in use in power plants at the time it was built. Additions were made to the equipment in the station until, in 1910, the installation consisted of ten vertical reciprocating engines and twenty-seven water-tube boilers. In that year the first steam turbine was installed, one of the



New 50,000 k.v.a. turbo-generator in place.

1500 kw. reciprocating engine units being removed and a 12,000 kw. turbo-generator installed in its place. This process was continued until, in 1919, four turbines had been installed and all of the original units had been removed except two large triple-expansion engines in the south end of the building. For the past ten years the station has depended on these four turbines, having a combined capacity of 57,000 kw., the two engines being kept in operating condition for emergency service but very seldom used.

When it became necessary to increase the steam electric generating capacity in San Francisco, it was decided to remodel Station "A" and install the most modern equipment that could be obtained. The plans call for an ultimate installation of four new turbines with four times the generating capacity of the older machines. The first of these new turbines is now in place.

The outstanding feature of the new plant is the high pressure for which it is being built. The boilers are being designed for 1400 pounds pressure, and the pressure at the turbine throttle will be 1250 pounds. There are only half a dozen steam stations in this country using such a high pressure. Station "A," therefore, will be one of the pioneers in utilizing the maximum pressure that has so far proven practicable for power-plant work. Just as a higher head enables a hydroelectric plant to produce more power

from the same amount of water, so a higher steam pressure enables the steam plant to produce more power from the same amount of fuel.

The high pressure, however, is not the only feature that brings about the high efficiency of the new station. In the older installation the boilers produce steam at 200 pounds pressure and superheat it to about 500° temperature, and the turbines take this steam and extract the energy from it until there is no pressure left, but, instead, a high vacuum is maintained. The steam then passes direct to the condenser giving up its latent heat, all of which is wasted. In the boilers the hot gases produced in the furnaces traverse the boiler tubes giving up their heat to them, and are gradually reduced to a temperature of about 500°. They then discharge direct to the smokestack, carrying a large amount of heat out with them. Thus there are two points in the simple steam plant in which large losses occur; namely, the heat carried away from the condensers by the circulating water and the heat carried away from the boilers to the smokestack.

In the modern plant both of these losses are materially reduced. The loss to the condenser is reduced by extracting considerable quantities of steam from the turbine before it reaches the condenser, and utilizing this steam for heating the feed water, thus re-

turning to the boiler both the sensible and the latent heat of the extracted steam.

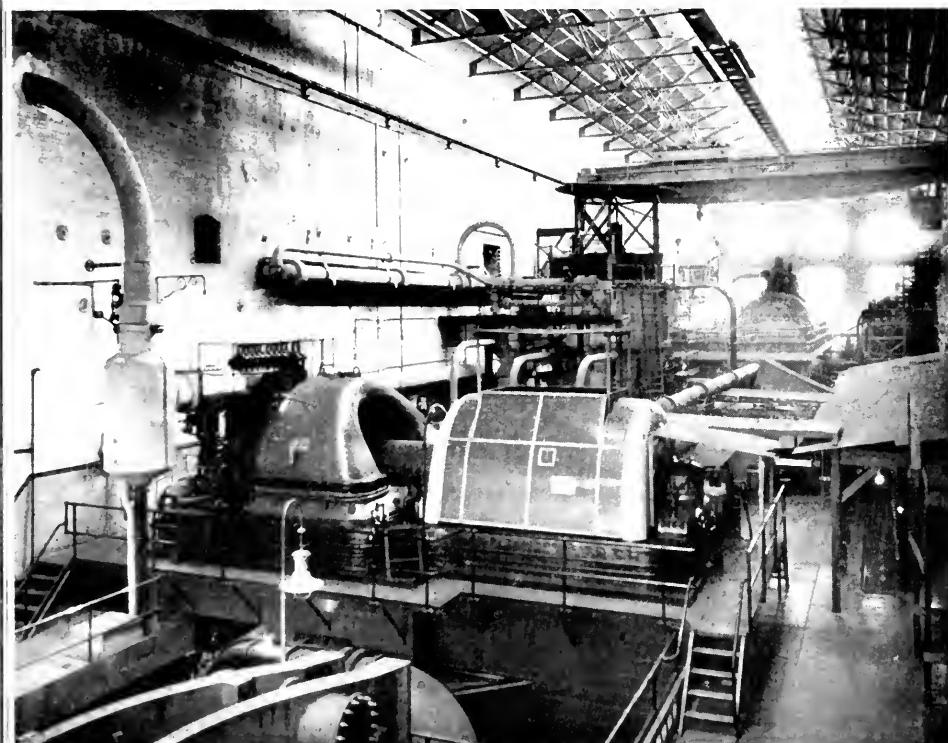
The heat lost to the smokestack is materially reduced by causing the hot gases to pass through an air-heater before reaching the smokestack. A large proportion of the heat in the flue gases is extracted from them in the air-heater and is absorbed by the air for combustion before the latter reaches the furnaces. This has the result of greatly reducing the amount of heat carried away by the flue gases going to the smokestack and, at the same time, insures hot air reaching the furnace, which is a large factor in insuring good combustion of the fuel.

The turbines are of the compound type, each unit consisting of a high-pressure turbine and a low-pressure turbine. The high-pressure turbine drives its own generator at a speed of 3600 revolutions per minute and has a capacity of 12,500 kw. The low-pressure turbine operates at 1800 revolutions per minute and is rated at 37,500 kw. The two together thus make a total rating of 50,000 kw. for the unit. A unique feature of this installation

is that the high-pressure turbine and its generator are set on top of the generator connected to the low-pressure turbine. Since the high-pressure element is much smaller than the low-pressure element there is plenty of room for it above the low-pressure generator. This arrangement does not interfere with the accessibility of the low-pressure machine, because the field of the generator is pulled out at the end of the unit, and as the high-pressure unit is above the generator and not above the turbine there is no difficulty in gaining access to the low-pressure turbine.

Both the high-pressure and low-pressure turbines are multi-stage machines, the high-pressure element having 14 stages and the low-pressure 17 stages. Steam is extracted from the 10th and 14th stages of the low-pressure turbine and, also, from the cross-over pipe between the two elements.

The low-pressure turbine receives the steam that has been expanded through the high-pressure turbine, but before reaching the low-pressure turbine this steam is taken back to the boiler room and passes through

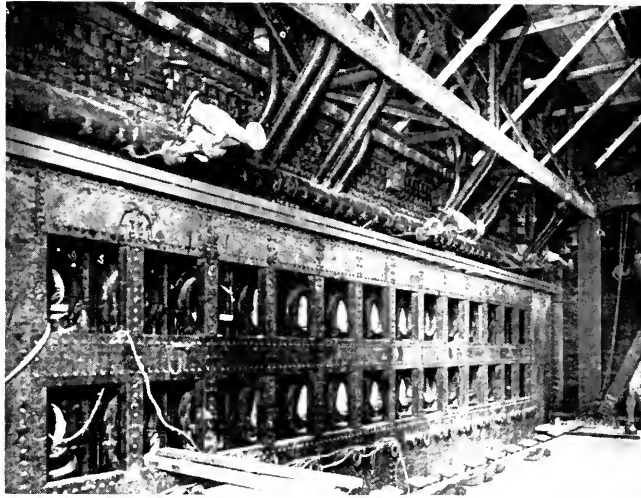


Turbine row at Station "A," showing new generator installed at far end and foundation for second unit excavated.

reheaters which superheat it up to a temperature of  $750^{\circ}$ . This is the same temperature at which the 1250-pound steam reaches the high-pressure turbine, but its pressure has now been reduced to below 400 pounds.

The reheating of this steam is accomplished in two steps; first, by a live steam reheater which utilizes steam at full boiler pressure for supplying the heat; second, by a flue gas reheater in the boiler setting. This arrangement results in a fairly constant temperature of steam leaving the reheaters at different loads.

After leaving the low-pressure turbine the steam passes to the condenser. In this installation the condenser is made with a divided water-box, so that one-half of the water space can be opened up without interfering with the operation of the turbine. This is a very desirable feature as it enables minor repairs to be made to the condenser with the turbine in operation. An unusual feature of the condenser installed at Station "A" is that the tubes are expanded at both ends into rigid tube sheets. The expansion of the tubes, due to varying temperatures,

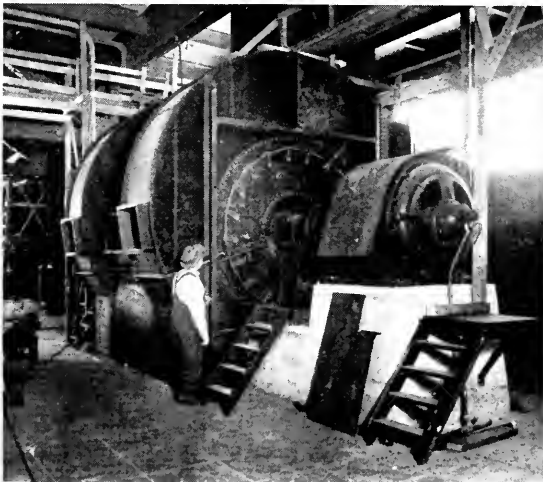


Front of No. 2 boiler in process of installation.

is taken care of by giving the tubes a slight bend. If the tubes expand they then bend a little further and if they contract they tend to straighten out. This arrangement does away with the necessity of packing between the tubes and tube sheet. As a great many of the troubles with condenser operation are due to packing leaks, it is expected that this design of condenser will prove much more satisfactory in operation than the older design.

The circulating water system has been reconstructed in the station by the building of two concrete ducts, one above the other, the intake water coming in through the lower duct and the discharge water going out through the upper duct. Two new pumps, each having a capacity of 50,000 gallons per minute, are being installed in the pumphouse. These pumps take the water after it has passed through the concrete intake and traveling screens, and discharge it through a cast-iron pipe which carries it up to the station. It then enters the above-mentioned concrete duct, which distributes the water to the different condensers. The discharge duct in the station is connected to a concrete tunnel which carries the discharge water back to the Bay.

Three boilers are being installed, each of which is capable of generating 500,000 pounds of steam per

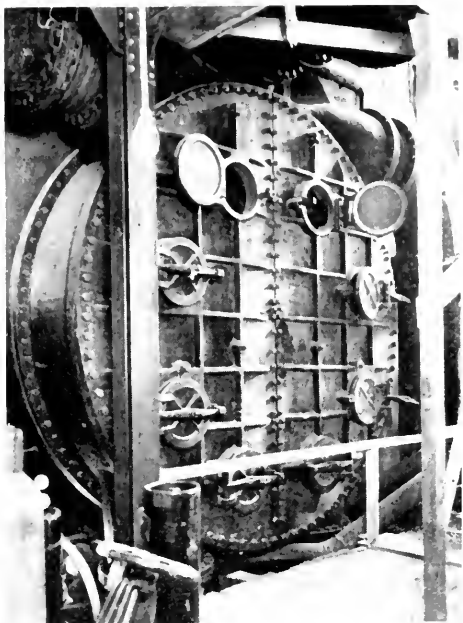


Induced draft fan for exhausting flue gases from the boiler.

hour. Two of these boilers are provided with reheaters so that the steam from No. 1 high-pressure turbine passes through the reheater of No. 1 boiler before reaching the low-pressure turbine. Similarly the reheater in No. 2 boiler takes care of the steam for No. 2 turbine. Thus each turbine is provided with its own boiler. The third boiler has no reheater, and it can supply high-pressure steam to either No. 1 or No. 2 high-pressure turbine. In case one of the reheat boilers is shut down for repairs, then the corresponding turbine will be supplied with steam from No. 3 boiler, and will operate without reheating. This means a somewhat lower efficiency during the period that the reheat boiler is shut down.

Each of the three boilers is provided with water walls on all four sides of the furnace, as well as a superheater, an economizer and an air preheater. The steam drums for these boilers are of massive construction, being 60 inches outside diameter with metal 4 inches thick. The drums are 50 feet long and weigh more than 50 tons. These drums are made from solid steel forgings and are machined inside and outside. There is not a riveted joint in the whole drum.

The furnace of the boiler is of large volume, being 42 feet wide by 16 feet deep and 21 feet high. This gives a total furnace volume of 14,400 cubic feet. Each of the reheat boilers is provided with 26 combination gas and oil burners, designed so that they can be readily changed from one fuel to the other. It will be possible to burn 562,000

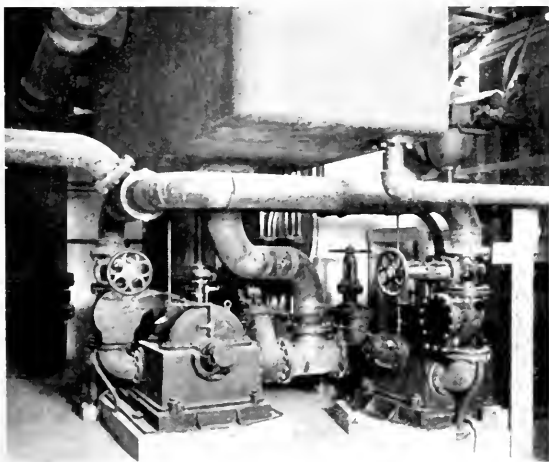


Front view of the new condenser.

cubic feet of natural gas per hour in the furnace of each of the reheat boilers. The firing of these burners will be controlled automatically to suit the load on the boilers.

At the high pressure to be used in this plant, the pumping of the feed water into the boilers becomes quite a problem. It requires 1600 horsepower to pump the requisite amount of water into each boiler at full load. The pumping of the feed water is to be accomplished in two steps. The primary pump will be driven by an electric motor and will pump the water up to a pressure of 600 pounds. The secondary feed pump will take the water at 600 pounds pressure and pump it up to the full boiler pressure, discharging it into the economizers. There will be one set of pumping units for each turbine and a spare set for the two turbines.

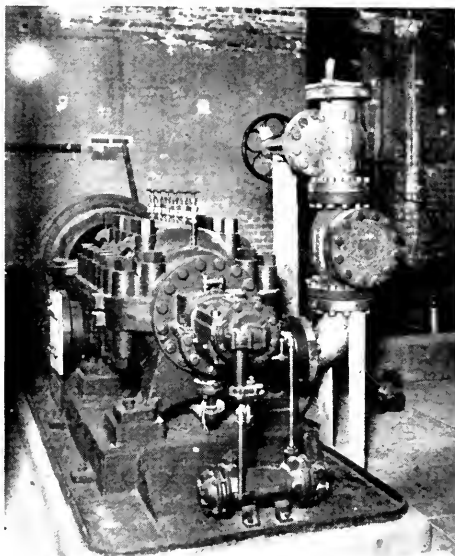
The secondary feed pump will be driven by auxiliary steam turbines, each pump having two turbines. One of these turbines will take steam from the cross-over pipe between the high and low pressure main units and will exhaust into one of the feed-water heaters. The



Condensate pumps installed under the new condenser.

other turbine will take steam from an auxiliary source, or direct from the boiler through a reducing valve, and will make up the quantity of power required to operate the feed pump when the steam obtained from the cross-over pipe is insufficient. It is thus seen that the feed pump turbines are intimately associated with the steam extraction feed water heater system.

An accompanying illustration shows the essential features of the plant in diagrammatic form. The steam is generated in the boiler at about 1350 pounds pressure and a temperature of 580° F. The steam first passes through the superheater where it is heated up to a temperature of 750°, and then passes direct to the high-pressure turbine. Owing to drop in pressure through the superheater and steam pipe, the pressure on reaching the high-pressure turbine is approximately 1250 pounds. When operating at full load, the steam exhausted from the high-pressure turbine has a pressure of 311 pounds and a temperature of 470°. This steam goes back to the boiler room to be reheated, but a portion of it is first drawn off to be used for heating the feed water and for driving the secondary feed-water pump. The main steam supply passes through the live steam reheater and the flue gas reheater in the boiler setting, where it again attains a temperature of 750°. It then passes to the

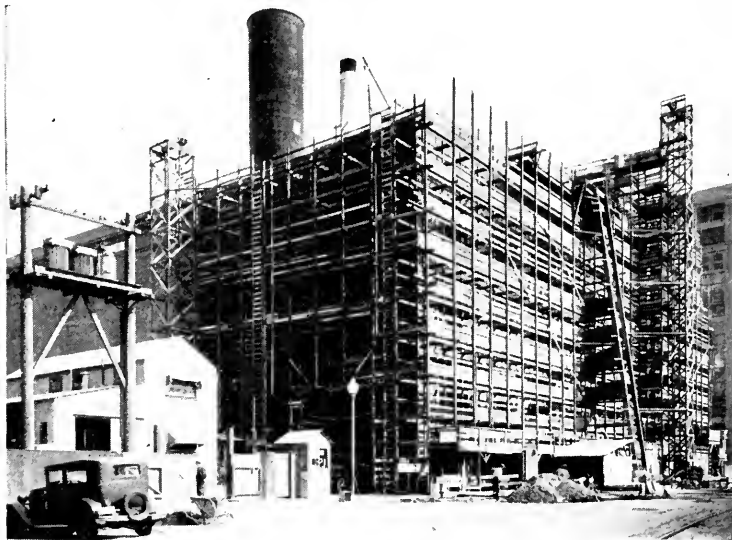


Primary feed-pump.

main low-pressure turbine, which it reaches at a pressure of about 293 pounds.

At the 10th stage of the low-pressure turbine a portion of the steam is extracted and is discharged partially to the evaporator and partially to one of the feed-water heaters. The evaporator is provided for the purpose

of purifying the makeup water added to the system. This is an essential feature of any plant operating at very high capacities, as boilers can be forced hard successfully only if they are entirely free from scale. The vapor from the evaporator passes into an open heater which is called a "deaerating heater." The vapor is then condensed and its heat is utilized in heating the water up to a point where



New switch-house will be located in an addition to the building 250 feet long, 40 feet wide and 75 feet high.

the dissolved air is driven off. The deaerating of the water is essential to guard against corrosion in the economizers and boilers.

At the 14th stage of the low-pressure turbine a certain amount of steam is also extracted. This steam goes direct to the first feed-water heater. Owing to the expansion of the steam as it passes through the main turbine, the steam extracted from the 14th stage is reduced in pressure away below the pressure of the atmosphere, and its temperature at full load is only 170°.

The main body of the steam passing through the low-pressure turbine finally reaches the condenser, where it is condensed and from which it is pumped out by the condensate pump at a temperature of 86°. The condensate pump forces this water through the first heater, where it is heated up to over 160°, and into the deaerating heater. From here the water is taken, at a temperature of 222°, by the primary feed pump and forced through three more feed-water heaters in turn, each of which adds a certain amount of temperature to the water. In this process it should be noted that the water is heated in steps in the different heaters, and after passing through one heater it reaches another heater which is supplied with hotter steam than the preceding one. Thus the last heater receives steam direct from the cross-over pipe, and heats the water to a temperature of 407°. At this temperature the secondary feed pump takes the water, and pumps it through the economizer

into the boiler. In the economizer the water is heated still further, to a temperature of 525°, by means of flue gases from the boiler.

In the fan room, which is located above the boiler room, a complete equipment of forced draft and induced draft fans is provided. Each boiler has a forced draft fan which forces air down through the air heater and into the furnace through the burners. The induced draft fan sucks out the gases of combustion which have to pass first over the boiler, then over the superheater, then past the reheater and the economizer and, finally, through the tubes of the air heater. Each of the fans is provided with two motors, one for operating at low speed for light loads, and the other for operating at high speed for heavy loads. Operation of the fans is controlled by the automatic firing system in conjunction with the feeding of fuel to the furnace. Thus the quantity of air provided is in proportion to the quantity of fuel burned, and this, in turn, is controlled by the quantity of steam required from the boiler.

It is of special interest to note that this new plant, one of the most modern in the country, has been designed entirely by our company's Engineering Department, under the direct supervision of Mr. R. C. Powell. Our General Construction Department is building the plant, with Mr. S. B. Harris as general foreman under the supervision of Mr. M. C. McKay.

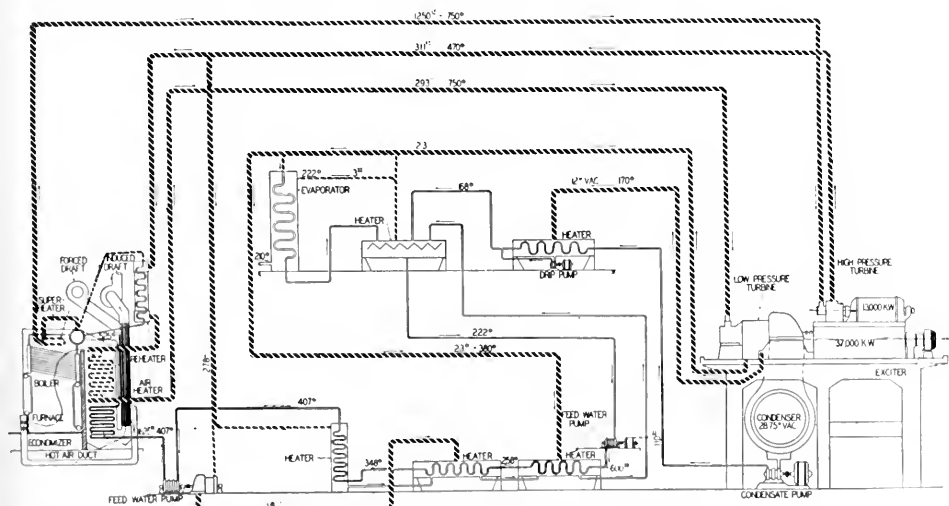


Diagram of Station "A," showing steam-piping and feed-water piping layout. The thin black lines mark water and the cross-hatched lines steam piping.



Henry F. Dierks



James Geekie



John H Godbold



Zeno Kutschker



James Canning



Charles H. McLean



Andrew M Gunneson



Carl Bouschin



Albert U. Brandt



James O'Brien

The "Pacific Service" honor roll. The above portraits are of ten former employees whose long and faithful service has earned them honorable retirement.

## "Pacific Service" Roll of Honor

Heading the honor roll of "Pacific Service" are 122 names of men whose long and faithful service to our company has been rewarded by their honorable retirement with provision for their declining years under our company's pension system, which underwent complete revision in the fall of 1921.

In preceding issues we presented the portraits of men whose names are upon our company's pension roll, accompanied by their several records. In doing this we were actuated by a desire to make our readers acquainted with these men and their records and to point out what is generally recognized in all up-to-date business enterprises, namely, that long and faithful service shall have its reward.

Opposite this will be found another installment of ten portraits of our company's pensioners. These are:

**James Geekie.** 75 years of age, having been born April 1, 1855. Entered the service of the Oakland Gas Light and Heat Company in December, 1888, and at the time of his retirement was employed in East Bay Division.

**Henry F. Dierks.** 73 years of age, having been born April 22, 1857. Entered the service of the Pacific Gas and Electric Company in December, 1913, and at the time of his retirement was employed in East Bay Division.

**John H. Godbold.** 73 years of age, having been born April 8, 1857. Entered the service of the Pacific Gas and Electric Company in October, 1911, and at the time of his retirement was employed in San Francisco Division.

**James Canning.** 71 years of age, having been born August 12, 1859. Entered the service of the Pacific Gas and Electric Company in April, 1909, and at the time of his retirement was employed in North Bay Division.

**Zeno Kutschker.** 71 years of age, having been born February 14, 1859. Entered the service of the South Yuba Water Company in June, 1895, and at the time of his retirement was employed in Drum Division.

**Charles H. McLean.** 66 years of age, having been born May 13, 1864. Entered the service of the Pacific Gas and Electric Company in April, 1914, and at the time of his retirement was employed in East Bay Division.

**Carl Bouschin.** 65 years of age, having been born March 26, 1865. Entered the service of the San Francisco Gas and Electric Company in September, 1903, and at the time of his retirement was employed in San Francisco Division.

**Andrew M. Gunneson.** 65 years of age, having been born December 10, 1864. Entered the service of the Oakland Gas Light and Heat Company in September, 1907, and at the time of his retirement was employed in East Bay Division.

**James O'Brien.** 64 years of age, having been born March 17, 1865. Entered the service of the San Francisco Gas Light Electric Company in September, 1891, and at the time of his retirement was employed in San Francisco Division.

**Albert U. Brandt.** 53 years of age, having been born April 11, 1877. Entered the service of the Independent Electric Light and Power Company in August, 1899, and at the time of his retirement was employed in San Francisco Division.

# The Financial Side of "Pacific Service"

## EARNINGS

Following is a preliminary statement of the Company's income account for the nine months ended September 30, 1930, compared with the corresponding period of the preceding year:

	9 MONTHS TO SEPT. 30, 1930	
	Amount	Increase
Gross (including Miscellaneous Income).....	\$56,346,113	\$7,640,534
Maintenance, Operating Expenses, Taxes (incl. Federal Taxes), Rentals and Reserves for Casualties and Uncollectible Accounts.....	24,756,665	1,196,251
Total Net Income.....	\$31,589,448	\$6,444,283
Bond Interest and Discount.....	9,174,330	1,403,814
Balance.....	\$22,415,118	\$5,040,469
Reserve for Depreciation.....	6,606,250	1,270,762
Surplus.....	\$15,808,868	\$3,769,707
Deduct Earnings of Subsidiary Companies prior to Acquisition.....	88,692	88,692
Balance.....	\$15,720,176	\$3,681,015
Dividends Accrued on Preferred Stock.....	4,717,399	1,064,477
Balance.....	\$11,002,777	\$2,616,538
Dividends Accrued on Common Stock (8% annual rate).....	6,922,362	2,375,587
Balance.....	\$ 4,080,415	\$ 240,951

The foregoing statement includes the earnings of the Great Western Power Company, San Joaquin Light and Power Corporation and Midland Counties Public Service Corporation merely from the date of acquisition by the Pacific Gas and Electric Company on June 12, 1930.

The balance of \$11,002,777 available for dividends on common stock during the first nine months of the current year was equivalent to \$2.41 per share upon the average of 4,565,819 shares of the company's common stock outstanding during this period. After the deduction of dividends accrued on this stock at the 8% annual rate which has been in effect during the past seven years, and which in the first three quarters of 1930 amounted to \$6,922,362, the balance carried to unappropriated surplus was \$4,080,415, or \$240,951 in excess of the corresponding figure in 1929. At September 30, 1930, 1,232,687 customers were taking service from the consolidated system, a net gain of 21,296 consumers since the beginning of the year.

Sales of electricity in the nine months ended September 30, 1930, aggregated 1,506,588,295 kilowatt hours, an increase of 50,351,694 kilowatt hours, or 3.46%, as compared with the aggregate sales of all companies now included in the consolidated system during the same period last year. This ratio of increase, while somewhat below the average of recent years, is considered satisfactory in view of a somewhat lower consumption of electricity by some of the company's industrial consumers, which is the natural accompaniment of the reduced activity in many lines of industry. In this connection, however, it is particularly encouraging to observe that the company's connected load, amounting at Septem-

ber 30th to 2,405,375 horsepower, showed an increase of 201,377 horsepower, or 9.13%, compared with September, 1929. This indicates a large potential increase in consumption when business conditions become more normal.

In the gas department the transition to natural gas, which has been under way for several months, is now practically completed. The change from artificial to natural gas renders it somewhat difficult to make a fair comparison of gas output with the same period last year, but it is interesting to observe that during the month of September sales of gas amounted to 1,908,234,300 cubic feet, an increase of 318,722,500 cubic feet, or 20%, compared with September, 1929. This increase is primarily attributable to the substantial growth in sales of gas for industrial purposes, the advent of natural gas opening up a very large market, not hitherto enjoyed by artificial gas, for the use of the new heating agent in manufacturing processes. Another important new outlet for natural gas is reflected in the sale during the first nine months of the year of 8,086 conversion burners, which were installed in furnaces previously consuming fuels other than gas.

### REFINANCING OPERATIONS

The company has embarked upon a comprehensive program of refinancing, which will result in substantial economies in annual carrying charges. Several bond issues of recently acquired subsidiaries have been called for redemption, the necessary funds being secured from the recent sale of \$25,000,000 par value First and Refunding Mortgage Series "F" 4½% Bonds due 1960. Bonds to be redeemed in the immediate future include the following:

Great Western Power Company of California 5-Year Gold Notes maturing November 2, 1930.....	\$4,000,000
Great Western Power Company of California First and Refunding Mortgage Series "A" 6% Bonds due March 1, 1949, called for redemption on December 1, 1930.....	5,681,900
Feather River Power Company First Mortgage 6% Bonds due serially to January 1, 1963, called for redemption January 1, 1931.....	5,399,000
Modesto Gas Company First Mortgage 6% Bonds due January 1, 1945, called for redemption January 1, 1931.....	152,000

Other outstanding bond issues which can profitably be refunded will also be called for redemption in the relatively near future.

As a further step in its plan eventually to merge the properties of the Great Western Power Company of California and subsidiary companies with its own system, the Pacific Gas and Electric Company has also filed an application with the State Railroad Commission for authority to offer its first preferred stock in exchange for the outstanding preferred stock of the Great Western Power Company of California and the Feather River Power Company, on the following basis:

- 2 shares of the Pacific Company's \$25.00 par value 6% first preferred stock and 2 shares of its 5½% first preferred stock for each \$100.00 share of the preferred stock of the Great Western Power Company of California.
- 4 shares of the Pacific Company's \$25.00 par value 5½% first preferred stock for each \$100.00 share of the preferred stock of the Feather River Power Company.

A circular letter outlining the details of this plan will be mailed to all preferred stockholders of the Great Western and Feather River Companies.

## Pacific Service Magazine

PUBLISHED QUARTERLY IN THE INTERESTS OF  
PACIFIC GAS AND ELECTRIC COMPANY

FREDERICK S. MYRTLE · EDITOR-IN-CHIEF

PACIFIC GAS AND ELECTRIC COMPANY  
245 Market St., San Francisco

*The Pacific Gas and Electric Company desires to serve its patrons in the best possible manner. Any consumer not satisfied with his service will confer a favor upon the management by taking the matter up with the division headquarters.*

VOL. XVIII OCTOBER, 1930 No. 2

On State Primary Day, August 26th, the registered electors of San Francisco by a significant majority vote rejected four municipal ownership propositions submitted to their consideration at the polls.

One called for a bond issue of \$44,600,000 to take over the local electric distribution system of the Pacific Gas and Electric Company; by a second it was proposed to raise \$18,945,000 to take over the local electric distribution system of the Great Western Power Company; by a third it was proposed to raise \$3,525,000 to build a transmission line from Newark to San Francisco connecting the properties proposed to be purchased with the Hetch Hetchy municipal system; the fourth called for \$1,045,000 to construct a power plant on the Hetch Hetchy water system at Red Mountain Bar in Stanislaus County.

All four propositions were decisively defeated. The first lost by a vote of 61,974 noes against 24,930 ayes; the second stood 62,343 noes, 24,894 ayes; the third 59,961 noes, 25,255 ayes; the fourth 59,525 noes, 25,425 ayes.

The law of California requires a two-thirds affirmative vote to carry a bond issue. Yet as the figures show, not one of the propositions received even a majority. More than that, the bonds did not receive a majority in any of the twelve districts into which the city of San Francisco is divided. Indeed, in some districts the vote against the bonds was as great as 4 to 1.

A considerable majority of the public press was opposed to the bond issues. Even some newspapers committed to the policy of so-called public ownership recommended against subjecting the gas and electric serv-

ice in San Francisco to political control. The *San Francisco Chronicle*, in an editorial published the morning after the bond election, had this to say:

"The people of San Francisco are to be complimented on their good sense in rejecting the scheme to buy the power distribution systems.

"The election has served the only real purpose in submitting the question to the people. Under the law the city, having put the power companies to the expense of a valuation proceeding before the Railroad Commission, was obligated either to vote on the purchase or pay those costs, amounting to about half a million dollars. The vote has been taken and the city is now quits with the Railroad Commission and the companies.

"As a serious proposal the scheme was utterly ill-advised. The city had nothing to gain and a great deal to lose. When the purchase question was ordered submitted first-rate political observers predicted that it would be snowed under at the polls. Nothing happened thereafter to change that opinion. The only backing the scheme had was from zealots determined to cram down the throats of the people public ownership of everything and anything.

"They got nowhere and evidently realized it, for they fell back on the bugaboo of interference by Washington. Of this it may be said that no one in the Government, either in the Coolidge administration when the power sale contract was made or in the present administration, has ever shown any disposition to make trouble for San Francisco over this contract. The question has never been raised in Washington except by San Francisco zealots for municipal ownership of everything or at their instigation. We have often wondered what the people of San Francisco think of citizens of their own city who, for the sake of an 'ism,' carry their tactics to the length of agitating a question embarrassing—so they say themselves—to their own city. These persons have actually worked hard to make trouble for San Francisco.

"Again we compliment the people of San Francisco on their good judgment."

Public men throughout the country have repeatedly expressed their belief that the people are disposed to judge and act fairly upon the problems submitted to them if they have a proper understanding of them. With that in view, the public utilities generally

are engaged in a campaign of public education, not, as the political agitator would have it, by means of political propaganda, but by means of an honest and public exposition of themselves, their working organizations, their facilities, their activities in the direction of service to their patrons. Their cards are on the table, so to speak. Their story is an open book, that he who runs may read. And, judging by recent happenings all over the country, it would appear that the frank and open policy pursued by the public utilities in regard to themselves and their activities is making its mark with the understanding public, that through this campaign of public education the people are acquiring a better insight into the public service and its problems and, in consequence, are more in sympathy with the public utilities than they once were.

However, although the reckless promoter of municipal fads and fancies does not get as ready a hearing as he once did he is by no means silenced; accordingly, the public utilities owe it to themselves to see that the true facts about them and their doings are laid before the public, their judge.

With the recent extension of service into the north bay section of "Pacific Service" territory our company's natural gas project which has been in process of construction since the beginning of 1929 is now practically completed.

It has been a record job, involving the construction of a 750-mile network of natural gas transmission pipe lines, covering the greater part of Northern and Central California, within a period of one year and nine months. It represents a capital investment of, in round figures, \$27,000,000, and has resulted in the displacement, within its area, of artificial gas as a commodity by a cheap and reliable fuel whose heating value is about double that of the artificial product. Through the increase in heating power and a proper readjustment of rates the proportionate annual saving to gas consumers on the company's books will run up into the millions, and to offset the resultant temporary drop in revenues the company is engaged in an intensive campaign of business development. The whole is in line with the company's up-to-date policy of SERVICE, by which is meant the most adequate and most efficient service possible at the lowest possible rate to the consumer.

With the major construction project completed, the company is engaged in extending its distribution system to make natural gas more easily accessible to factories and homes. The total bill for these extensions will run into several hundred thousand dollars. Unquestionably natural gas is destined to be the universal fuel of the future for industrial as well as for domestic purposes. Already within our "Pacific Service" territory large industrial establishments are scrapping their heating systems and availing themselves of the opportunity to make use of a fuel that is entirely satisfactory, easy to handle and whose supply is practically unlimited. Natural gas transmission has solved a great industrial problem and, in consequence, is aiding the spread of industry throughout the interior of California. Completion of the first "Pacific Service" transmission line from the San Joaquin Valley oil fields to the Bay area, followed, as it was, by a second line constructed in co-operation with the Standard Oil Company, marks but the beginning. Extensions in every direction are probable within the not far distant future.

The daily supply of natural gas coming into the Bay area and its distribution to various parts of the "Pacific Service" territory are controlled by the company's Natural Gas Division at San Francisco headquarters in much the same fashion as the output and distribution of electrical energy from the various power plants in the system are controlled by the company's Load Dispatcher. The supply varies, of course, with the demand. It is all very interesting and instructive.

The Pacific Coast Gas Association convention held in September at Pasadena was in many ways the most important in the history of the Association. It broke all records for attendance. There was a registration of 566 and in this all of the Western States were represented as, also, British Columbia and many points east of the Rockies.

A feature of the proceedings was an address by Mr. C. O. G. Miller of San Francisco, President of Pacific Lighting Corporation, a member of our company's Board of Directors, and for a lifetime an outstanding figure in public utility affairs. Mr. Miller traced the progress of the gas industry in California from its introduction by the San Francisco Gas Company in 1854 to the present day. Dealing with the future outlook, Mr. Miller made the following prediction:

"I believe that by 1954 the principal industrial centers of the country will use gas almost exclusively for all fuel requirements. Where it can be done, natural gas will be piped from gas and oil fields to the populous centers. In other cases, coal will be converted into gas at the mine and the gas will be transported to the homes and factories of distant cities. Modern methods of pipe-making and pipe-laying will make it possible to cover distances now undreamed of and pipe lines will interconnect gas systems over widespread areas with loads remarkable for their diversity and density."

At the Pasadena convention Mr. R. E. Fisher, our company's Vice-President in Charge of Public Relations and Sales, was elected president of the Pacific Coast Gas Association for the ensuing twelvemonth. Mr. D. G. Martin, also of "Pacific Service," was re-elected treasurer and Mr. John P. Coghlan, our company's Second Vice-President and Assistant to the President, was elected a director.

The recent completion of our company's electric transmission lines into Kelsey, El Dorado County, brings to light an early day installation that will be of interest to many of our readers.

In October, 1888, according to the *Placerville Mountain Democrat*, George Cullen Pearson, manager for the Gopher Boulder and Dalmatia mines at Kelsey, returned from London and gave notice that electricity would thenceforth be used for motive power on their properties. Engines and boilers were sold and the two mines made over for electric drive. At the same time, a hydro-plant was built on Rock Creek, just across the stream from our company's present American River plant near Placerville.

The power-house equipment consisted of a Brush Electric Company series generator belt-driven from a countershaft in turn driven from a 100 H.P. Pelton wheel. There was no governor, but an ammeter and voltmeter were provided. It was the practice to hold about 25 to 40 amperes by varying the voltage up to a maximum of 1500 volts. It was necessary to regulate the water and brush holders for each load change.

The main motor at the Gopher Boulder mine was an exact duplicate of the generator at the plant, while the motor at the Dalmatia mine was a series motor of another type.

This entire installation was completed and put into operation in 1890, operating more or less continuously until the power-house was destroyed by fire in 1898. The journals of the day gave wide publicity to the event and visitors came from distant points to witness the operation of the new power that had supplanted steam.

Today the lines of the Pacific Gas and Electric Company enter Kelsey along practically the same route as that followed in 1890, past Tom Allen's place, where James W. Marshall used to hobnob on winter evenings, and near the site of the Union Hotel where Marshall spent his last days. So, after a lapse of thirty-two years the steady pulse of "Pacific Service" has picked up the burden. Once more is heard the dull rumble of stamp mills, and while the bustle and excitement that were characteristic of the prosperous early day California mining town are absent they have been supplanted by a more stable and substantial activity, for back in the fertile valleys agriculture is gradually asserting itself, while today through "Pacific Service" scores of homes are enjoying all the conveniences that modern ways of living demand.

Within the past six months orders for 16,200,000 pounds of copper wire have been placed by our company with manufacturing firms in the East.

One contract, placed with the Anaconda Wire and Cable Company of New York, calls for 166 miles of one-inch hollow-core copper cable to be used in construction of the 110-mile double-circuit, steel-tower line by which electrical energy developed at the Salt Springs and Tiger Creek power plants on the Mokelumne River will be transported across country to our company's high-tension distributing station at Newark in Alameda County. This is, so far, the largest order for hollow-core cable in the history of the Western States. It will require at least 60 freight cars to transport it across the continent.

The balance of 12,000,000 pounds, contracted for equally between the Anaconda Company and the General Cable Company of New York, is estimated to be sufficient to meet normal requirements for electrical transmission and distribution purposes from the present time to the end of 1931. It costs money to maintain as well as construct a system like that of "Pacific Service."

# PACIFIC GAS AND ELECTRIC COMPANY

A CALIFORNIA CORPORATION

Managed by Californians

Operated by Californians

## THE CONSOLIDATED "PACIFIC SERVICE" SYSTEM REPRESENTS

16,000 employed in all departments.

\$600,000,000 capital invested in gas, electricity, street railway, steam and water plants.

85,000 square miles of territory in which it operates — an area greater than that of England and Wales.

85,000 stockholders.

45 counties of the State in which it transacts business.

1,231,381 consumers served with gas, electricity, water and steam.

2,750,000 people in 45 counties, which is approximately 50 per cent of the State population.  
609 cities and towns in which it supplies service directly and through other companies.

\$29,400,000 annual wages paid employees, year ending August 31, 1930.

\$9,069,358 taxes, Federal, State, county and local, year ending August 31, 1930.

1,081,881 horsepower developed in 48 electric water-power plants.

418,364 horsepower developed in 15 electric steam plants.

1,500,245 total horsepower developed in 63 plants.

3,311,830,000 kw. hours sold, year ending August 31, 1930. This is equivalent to the effort of 11,039,000 men.

22,367,488,400 cubic feet of gas sold, year ending August 31, 1930.

24 gas plants.

33,204 miles of transmission and distribution lines. Greater than the distance around the earth.

6,800 miles of mains used in distributing gas. Greater than the distance between San Francisco and Oslo, Norway.

955 miles of mains and ditches used in distributing power.

1,370 miles of track of railway supplied with electric power.

616,395,950,000 gallons of water storage capacity of 115 lakes and reservoirs. This amount of water would supply the City of San Francisco at the present rate of consumption for approximately 34 years.

218,484 acres of land owned in California.

550 parcels of property owned in cities and towns.

2,047,097 barrels of California oil used, year ending August 31, 1930.

547,549 horsepower in agricultural motors depending on "Pacific Service."

1,409,774 horsepower in mining, electric railways, manufacturing and other motors depending on "Pacific Service."

19,810,634 incandescent lamps nightly lighted.

3,762,304 horsepower connected to system.

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General Offices: 245 Market Street

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Branches in all principal cities and towns of 45 counties of North Central California.



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*if you own* Pacific Gas and Electric Company First Preferred Cumulative Stock.

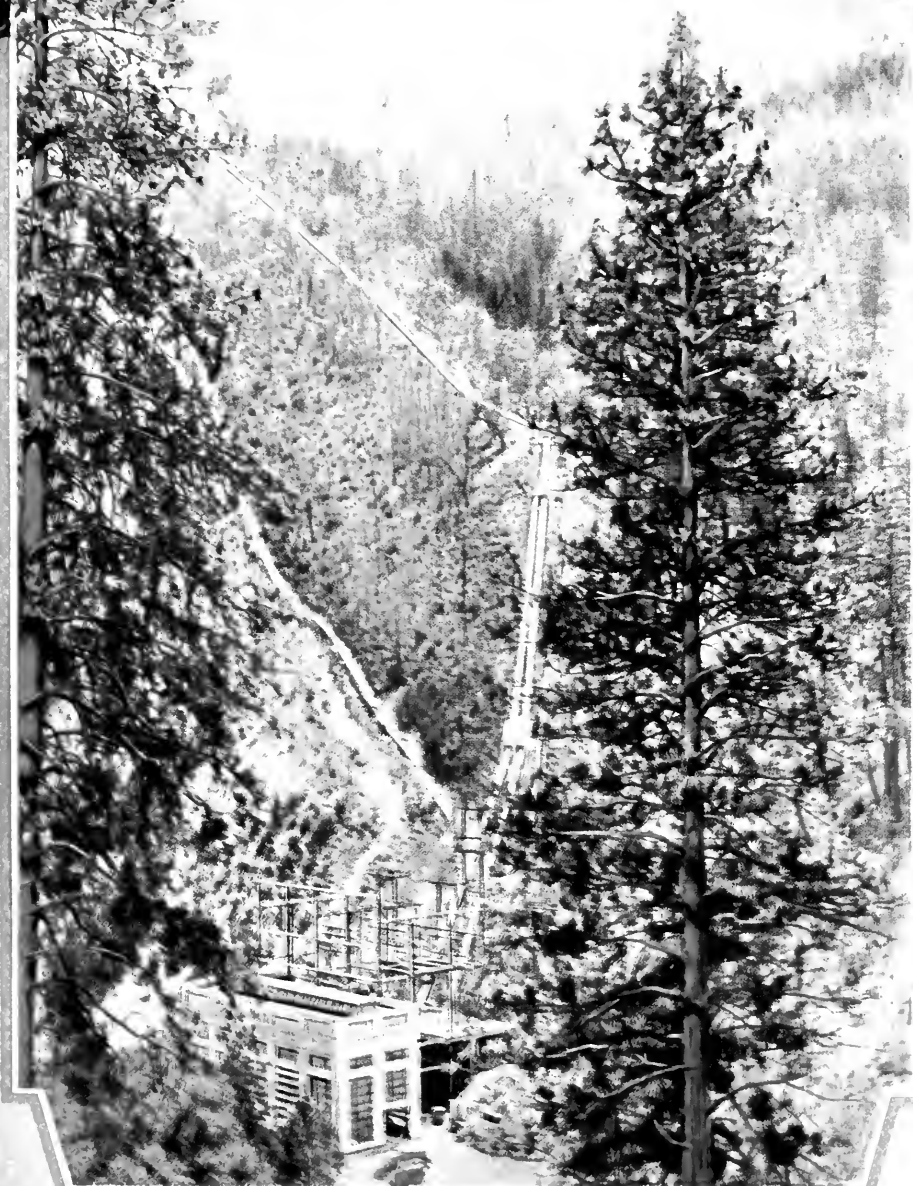
In good times and bad, in boom and depression, this Company's First Preferred Stock has never failed to pay dividends with the most punctilious regularity. The forty thousand holders of this high-grade security never need to entertain the slightest uneasiness as to the safety of their investment.

The Company is now offering a limited amount of its First Preferred 5½% Stock for sale direct to its customers and other residents of territory served.

Circulars descriptive of this investment issue will be mailed upon request.

**PACIFIC GAS AND ELECTRIC COMPANY**  
STOCK SALES DEPARTMENT • 245 MARKET STREET • SAN FRANCISCO

# PACIFIC SERVICE MAGAZINE



EL DORADO POWER PLANT - AMERICAN RIVER

Vol  
18

JANUARY 1931

For  
2

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# Pacific Service Magazine

Volume XVIII

Number 3

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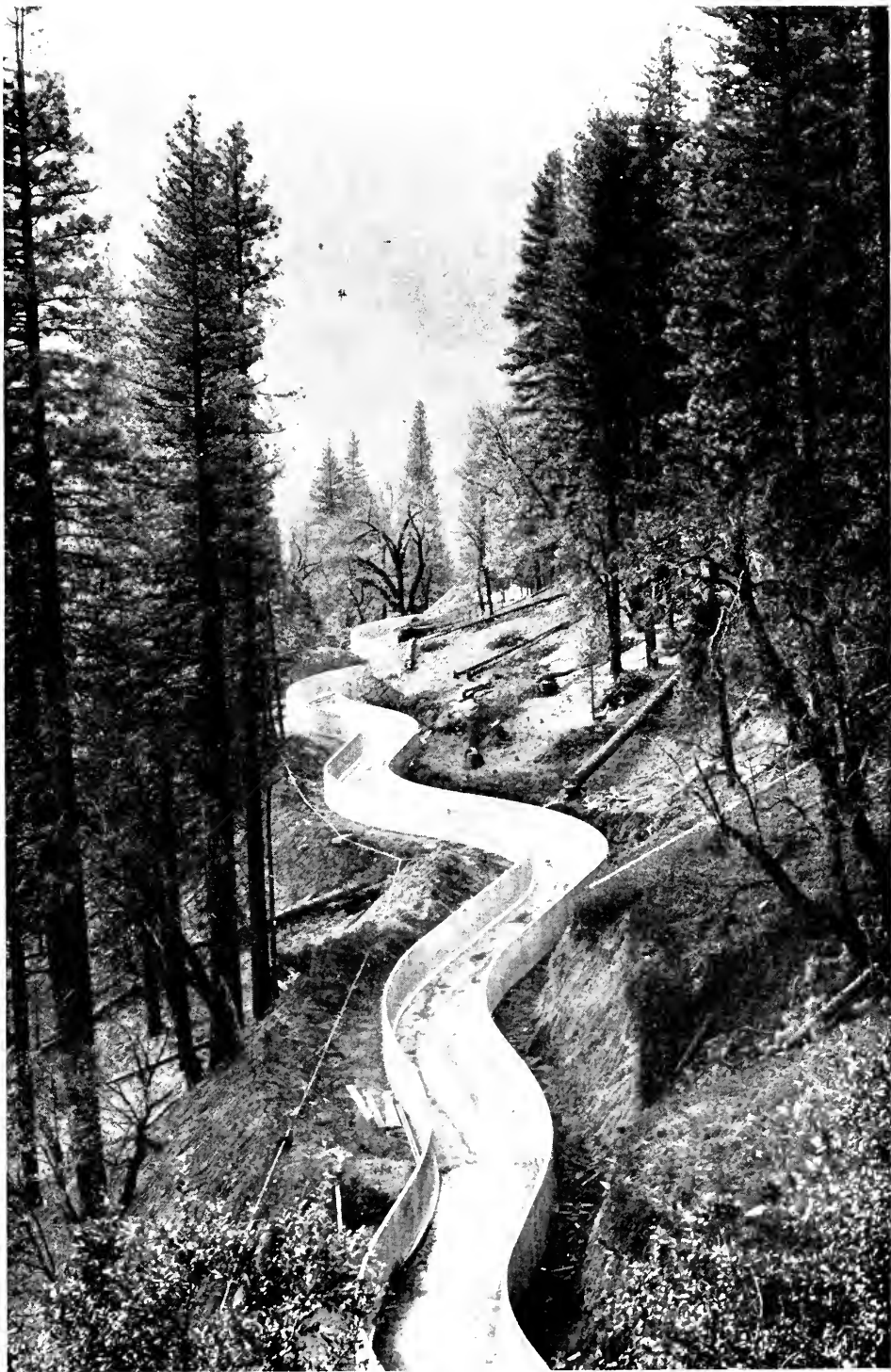
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Section of completed concrete flume which will convey water from Salt Springs dam to Tiger Creek power plant. Mokelumne River development.

## State Supervision of Design and Construction of Dams in California

By A. H. MARKWART, Vice-President in Charge of Engineering

The failure of an engineering structure, unless attended by loss of life or property, does not usually attract the attention of the layman. When such a failure results in damage to property only, it is of interest to the owner of the structure and to any party which may have suffered loss. When, however, the failure involves loss of life as well as damage to property, it becomes a tragedy which is the subject of great concern to the general public.

There are probably no engineering structures which the public fears more than dams. While the layman, as a rule, cannot visualize the effects of failure of other engineering works, the destruction which would follow the carrying away of a dam is to him most apparent. For this reason, there is perhaps more popular interest in dams than in other engineering construction.

The failure of the St. Francis dam in Southern California in 1928 was a tragic occurrence which prompted many to question seriously the stability of existing dams. It does not follow, however, that the building of dams must be discontinued, any more than that mining operations should be dis-



Meadow Lake, Nevada County. Rock-fill dam completed in 1863.

continued because of loss of life in coal-mining operations. The conservation of fuel resources by the building of storage works for power purposes must be continued, with greater emphasis, if need be, upon their safety. The irrigation of lands from storage resources must be continued and there must be built flood control reservoirs, unless other and better means are devised for handling flood flows. What the failure of the St. Francis and other ill-fated dams teaches, is the necessity of introducing greater conservatism and sounder judgment, particularly the latter, in the design and execution of such structures.

It is being more and more realized, as intelligent investigations of dam failures are made, that the critical defects have been al-

most invariably avoidable, had proper judgment and foresight been exercised in the design and construction. Such avoidable defects can be eliminated almost entirely with effective regulation and control.

In exerting supervision over dams, the State is merely exercising one of its police functions in the interest of the public. State supervision of dams is desirable if properly administered, and undesirable if not properly done, since it then gives a false security to those who place their trust in its protection.

State interference in private matters is always to be deplored, but protection to life, health and property is in the public interest.



Lake Fordyce, Nevada County. Original dam built by South Yuba Water Company in 1875. Raised 16 feet in 1881 and in 1927 reconstructed to a height of 140 feet above stream-bed.

Where these are endangered, it is regrettable, but true, that resort to government is invariably had to effect correction. The reform movement, which always follows, finally centers in governmental pressure further restricting the individual or local group.

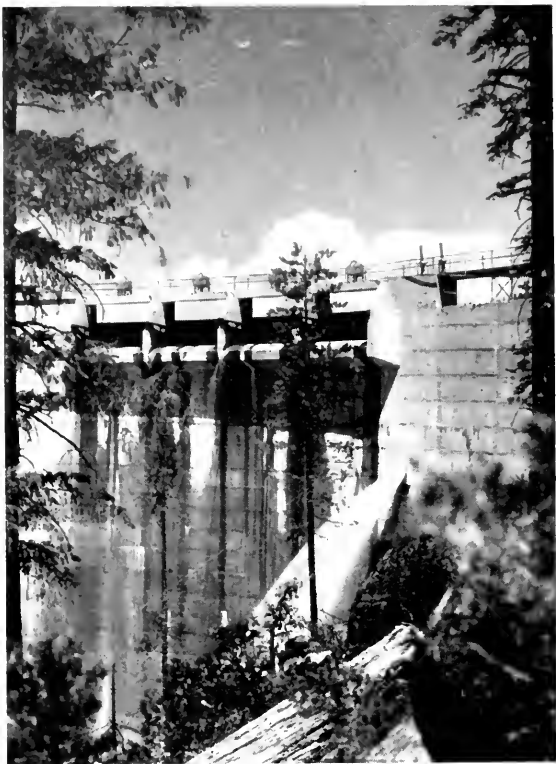
The same result might have been achieved by action from within the group affected, if those in responsible position would voluntarily exercise the necessary control over dangerous practices. Individuals, corporations, and local governments should of themselves know what is essential for the protection of life and property, and impose the self-discipline necessary to eliminate the risks. It is apparent, however, with human na-



Old timber-crib dam at Lyons Reservoir, Tuolumne County. Height 55 feet. Built in 1898.

ture constituted as it is, that this control from within is not to be expected.

The public has a right to the protection of life and property from the possible failure of dams which impound large volumes of water and, in the absence of self-imposed regulation, it is the duty of government to provide legislation to that end. This will not necessarily provide a perfect assurance of safety, however, because the criticism may be made not only that governmental agencies are no more infallible than private agencies, but that the very engineers responsible for the design of dams which have failed would all have been qualified to act as consulting engineers in the service of State regulation. The value of State supervision does not consist in requiring of the owner the employment of a consulting engineer, but rather in requiring an independent review of the design, insuring the application of more than one mind to the problem. In the words of the findings of the St. Francis dam disaster, "the construction and operation of a great dam should never be left to the judgment of one man, no matter how eminent."



New 110-ft. concrete dam at Lyons Reservoir.  
Completed in June, 1930.

In California, prior to August 14, 1929, the design of dams to be erected by privately owned public utilities was subject to the approval of the State Railroad Commission. The Railroad Commission had no jurisdiction, however, over the acts of municipally or other governmentally owned utilities. Dams to be erected by private agencies other than public utilities were subject to the approval of the State Engineer. In addition, several Federal offices exercised supervision to various degrees over debris dams, dams owned by the Federal government and those occupying sites on public lands. The plans and specifications of the St. Francis dam were not subject to the approval of the State Engineer because the City of Los Angeles had an engineering Department; nor were they subject to the State Railroad Commission because the dam was erected by a government agency. On the other hand, the dams of the Los Angeles Flood Control District, another governmental agency, were subject to the approval of the State Engineer because the district had

not a regularly established engineering department. These fine distinctions seem peculiar, because if one dam needs supervision all need it.

The failure of the St. Francis dam focused the attention of the State legislative body on the necessity for concentrating the supervision of dams under one central control. As a result, the 1929 legislature, under the police powers of the State and for the purpose of safeguarding life and property, invested the duty of the supervision of the construction and maintenance of all dams, with the exception of those owned by the United States, in the Department of Public Works, under the administration of the State Engineer. This law repealed all other State acts governing the supervision of dams.

The new California law states that all dams in the State, whether heretofore or hereafter built or then under construction, shall be under the jurisdiction of the Department of Public Works, as administered by the State Engineer, and that it shall be un-

lawful to construct, enlarge, repair, alter, remove, maintain or operate any dam except with the approval of that department. All dams fifteen or more feet in height from the stream bed to the crest of the spillway, or impounding ten acre-feet or more, are subject to this control. Smaller dams and dams of any size belonging to the Federal government are exempted from State supervision, the latter because of the lack of

sovereignty of the State over the actions of the Federal government. The Department of Public Works is invested with this authority under the police power of the State, and the supervision is therefore properly limited to

that necessary to safeguard life and property.

Three years from the passage of the Act were allowed for the inspection and approval of the many existing dams. If found satisfactory to the State Engineer, a certificate of

approval is issued to the owner. If not satisfactory, the department issues orders directing the necessary corrective work to be done, and fixing a limiting time for its completion. When this has been satisfactorily accomplished and the dam is brought to the required standard of safety, the certificate of approval is given.

The owners of existing dams were required, by the Act, to file applications for the approval of the structures under



Meadow Lake, in Alpine County. Rock-fill dam constructed in 1903. Original timber facing replaced with gunite in 1930.



Lake Frances dam, Colgate power development. One of the earliest hydraulic-fill dams ever constructed. 1902.

their control prior to February 1930, and failure to do so, after warning, was made a misdemeanor.

Before the construction of a new dam may be started or before an existing dam may be raised, the owner must apply for and receive approval upon the site, and the plans and specifications for his construction. When these are found satisfactory, the approval is granted, subject to any stipulations found necessary to insure the safety of the dam. During the construction, inspections, either continuous or periodical, are made by a representative of the State Engineer. Particular attention is given to the underlying foundation materials and the methods and workmanship employed in the substructure. Until these are inspected and found acceptable, no construction above may be started. If the design is deemed unsafe or unsatisfactory to meet the conditions at the site, it is required to be corrected. When the suitability of the foundation bed is questioned, treatment is insisted upon. In those extreme cases where corrective measures are impracticable, the application is rejected, and work on the project must cease. Moreover, if the construction is not conducted in conformity with the stipulations, the approval to construct may be withdrawn and the owner required to discontinue his operations.

In putting the Act in operation, dams which were at that time under construction and less than 90 per cent complete were deemed to be new dams, and subject to the formal approval of plans, although the construction work was permitted to continue in the meantime.

Upon the completion of the work, the owner files a notice of completion, supplemented by certain technical information and a statement of cost. Following this comes a



Lake Spaulding, controlling reservoir of the Spaulding Drum system. Concrete arch dam first constructed in 1913 and since raised. Height, 275 feet above the South Yuba.

final inspection by the State Engineer and the issuance of a final certificate of approval, if all is found to be satisfactory from the point of view of public safety. Until this certificate, or in its place a written order setting forth certain operating stipulations, is obtained from the Department of Public Works, no water may be impounded behind the dam.

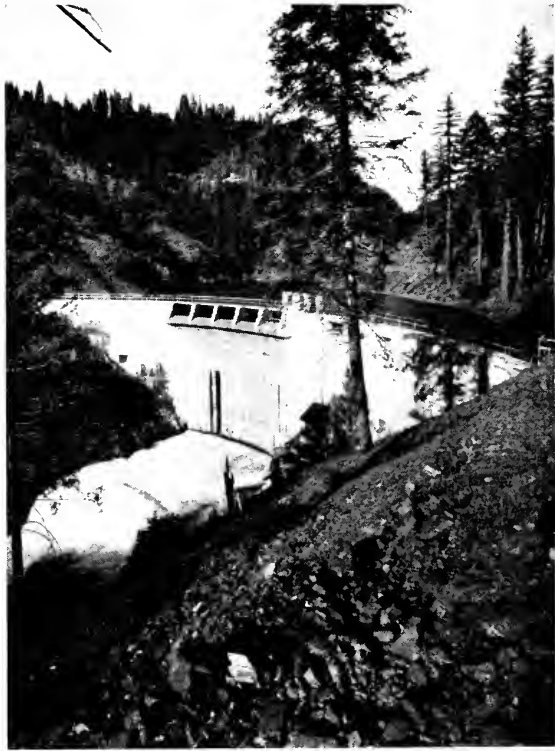
A substantial filing fee, based on the estimated cost of the dam, must accompany the application for the approval of the plans. This is subject to adjustment when the actual cost is known. It is intended that the income from fees shall be sufficient to carry the cost of the State supervision.

The Act also grants to the State Engineer control over the repair, alteration and removal of existing dams, as well as their maintenance and operation. If a dangerous condition arise, he may issue and enforce orders requiring repairs, the lowering of the water, the drainage of the reservoir, or other remedial measures to insure the public safety. On the other hand, in an emergency, an owner may act without awaiting formal approval, provided the State Engineer's office is advised of the situation.

Provision is made in the Act for the appointment of a board of consultants, in the event of disagreement between the State and

the owner. While the language of the Act does not make the decision of the consulting board binding on the State Engineer, the opinion of engineers of the type which he would nominate for such a board would undoubtedly influence his decision, strongly. As a final measure, an owner may seek relief in the courts from what he may consider unwarranted interference or unnecessary expenditures. Such recourse to the courts will rarely be invoked, in all probability, and only when the owner believes the burden imposed to be unbearable.

At the time the new legislation became effective, the Pacific Gas and Electric Company was actively engaged in the construction of our now widely-known Salt Springs dam, and in the enlargement of the Silver Lake dam. Work at Lyons dam, on the South Fork of the Stanislaus, having just been begun, was constructed entirely under the new State supervision. The transfer of supervision from the jurisdiction of the State Railroad Commission to the State Engineer's office was accomplished, without interruption of the construction, through an informal but most effective arrangement between the two State authorities. Work at Silver Lake was completed shortly after the Act became operative, but the Salt Springs con-

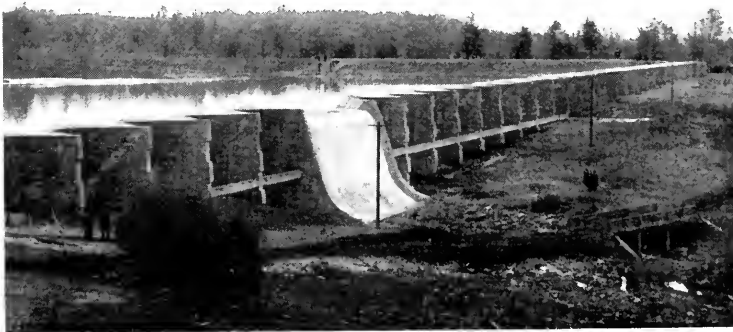


Afterbay dam, Drum power development.  
Constructed in 1924.

struction is still in progress and will not be completed until midsummer of this year.

Two new dams now under construction on the Mokelumne have recently been added

to those discussed above. The Tiger Creek regulator dam, of the buttressed-slab type and one hundred feet in height, is now about one-half completed. The site for the Tiger Creek afterbay dam, an arch structure about one hundred feet high, is now being excavated and construction started. Both of these structures are to be completed



Rock Creek dam, Wise power development, near Auburn in Placer County.  
Multiple arch type. Constructed in 1916.

about the middle of the present year.

In the matter of existing dams, the company has filed applications for the approval of one hundred dams, exclusive of those on the systems of the Feather River Power Company, the Great Western Power Company and the San Joaquin Light and Power Corporation. Of these 41 are on the South Yuba system alone. Several of the dams are under Federal as

well as State jurisdiction, and any material alterations must be approved by both authorities.

Many of the older dams on the company system were constructed by early water or mining companies, in inaccessible locations, and at a time when permanent construction

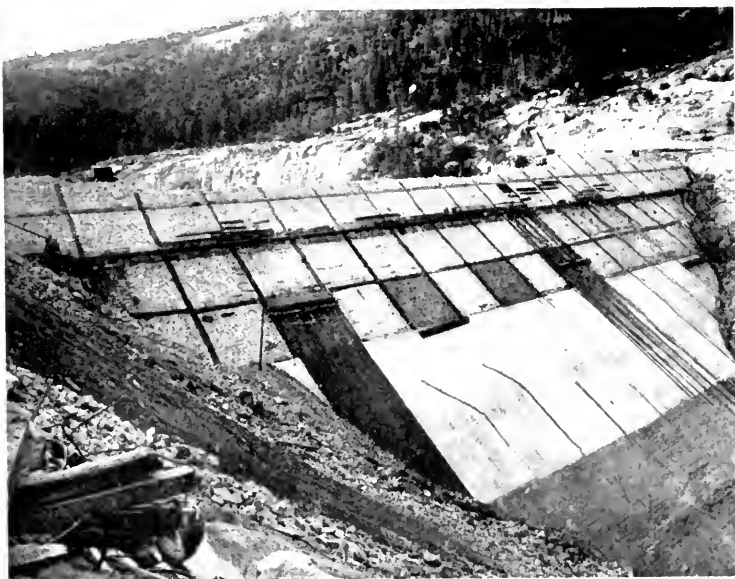
was considered to be too expensive. Little, if any, information was then available for arriving at the proper capacity for spillways and it therefore became customary to have attendants immediately available throughout the year. Where such temporary construction was used, it has been necessary, periodically, to repair or

replace outlet works, spillways or even portions of the dam itself, and where spillways have been considered inadequate, they have been enlarged. Work of this type has been a matter of routine nearly every summer somewhere in the high mountain areas of the "Pacific Service" System.

Prior to the enactment of the new law, this work could be carried on without the approval



Dam at Pit River No. 4 development. Completed in 1927.



Upstream face of Salt Springs dam. Mokelumne River, nearing completion. Its height will be 328 feet above the bed of the stream.

of any supervisory organization, but, as previously described, such work must now receive the sanction of the State Engineer. Since the new law was passed, several alterations have been completed and many more are being planned for the summer construction season of 1931. Spillways constructed of timber will generally be made more permanent. Flashboards will be eliminated on the spillways of dams in remote places. Spillway capacities will be increased where necessary and outlet works will be replaced if their physical condition has deteriorated. Office investigations of flood flows and related factors are now being made and at this date several further alterations are being considered.

Alterations have been completed and approved on eight existing dams, since the new supervision was instituted. Ten more dams are now under application for approval and 19 others are programmed for this year and the next. To date about \$65,000.00 has been expended in this reconstruction and maintenance

work, with approximately \$335,000.00 more anticipated during 1931 and 1932.

This program of construction will result in appurtenant structures of more permanent type, increased spillway capacities in the light of longer stream flow records, lessened need for attendants and, for the future, lessened expenditures for maintenance.

In the administration of the duties conferred upon the State Engineer by the new legislation, a fine spirit of co-operation has been evinced at all times. Dam construction has been termed "a splendid adventure," and true it is, for unforeseen and difficult conditions arise and alterations in the original plans and decisions must be made with the least possible hindrance of the work. Such situations, as they arise, require the fullest co-operation among all parties involved. In this the State representatives have been most helpful, and have shown their understanding of their duty which, under the police power of the State, is primarily to see that public safety is assured.



# Natural Gas Becomes a Prominent Factor of Industrial Development

By J. H. GUMZ, Industrial Gas Engineer

Natural gas, piped into the "Pacific Service" territory by high-pressure transmission from the San Joaquin Valley oil-fields, is making rapid strides toward general acceptance as the ideal industrial fuel.

Its popularity in the household has already been firmly established. Domestic users in all sections express themselves highly pleased with it. Apart from its cleanliness and efficiency it is economical by reason of its heating quality, which is double that of artificial gas; this feature makes itself manifest in the uniform reduction of gas bills. The test has been made and all that was claimed for the new commodity has been proven by the record of the period during which the greater number of our company's consumers have been enjoying natural gas service.

From the standpoint of revenue to the company, however, the introduction of natural gas must result in a decrease of income, should its general use be no greater than was recorded for the artificial commodity it has displaced. To offset this, therefore, our company is prosecuting an intensive sales campaign for the purpose of interesting the public generally in the diversified uses of the product. Domestic business is susceptible of material increase not only through the enlistment of new consumers but, also, through stimulation of trade in labor-saving gas appliances for the household; but it is to the commercial and industrial activities, in particular, that the company looks for volume of business that will not only fill the gap in revenues but even raise those revenues to proportions that will ultimately prove the company's expenditure of \$27,000,000 and upwards on the natural gas project to have been more than justified from a financial standpoint, to say nothing of its being in line with the company's policy of giving the best and most up-to-date service



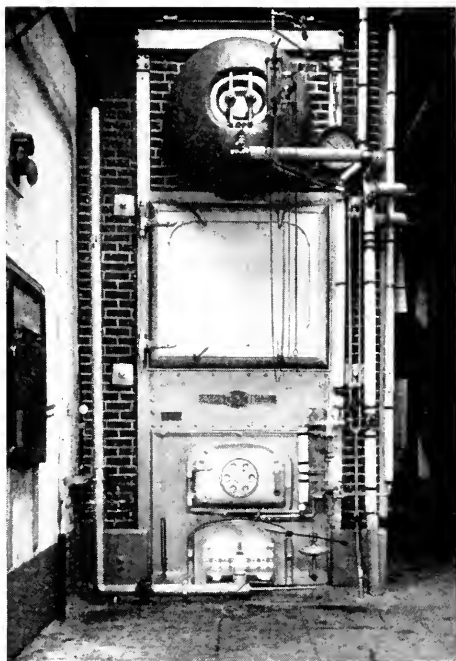
The Hunter-Dulin Building, San Francisco.

within its power at the lowest possible cost to the consumer.

The company for years had been selling gas for commercial purposes and, also, for industrial manufacturing uses, but the potential market was far from being completely supplied with gas as a fuel. The high cost of the manufactured product was generally accepted as the reason for this. Accordingly, it appeared to the company's management that in natural gas lay the solution of the industrial problem. Surveys dating as far back as 1923 and 1924 were studied and brought up to date to determine just exactly what the fuel requirements in Northern California were. It was found that, aside from manufactured gas, practically all the fuel requirements were being supplied by fuel oil. It

was also found that the bulk of this fuel oil in industrial operations was used to fire steam boilers. These boilers ranged in size from 5 to 1,000 horsepower each and were used in all combinations. That is, some plants might have a single boiler and other plants might have a battery of 15 to 25 boilers. It was also found that the boilers were of almost every conceivable make. An interesting sidelight in this connection is that there are probably more Scotch marine boilers in the San Francisco Bay area than almost any other type. This, no doubt, is as a result of many of these boilers being used on board ship, and San Francisco being a shipbuilding center, there was presented an excellent opportunity for the makers of Scotch marine boilers to sell their wares for land use.

The surveys indicated that some 6,000,000 barrels of oil were being used annually for industrial operations in the territory served by Pacific Gas and Electric Company. Investigation of the amount of industrial fuel oil used under boilers indicated that even though gas might be somewhat cleaner and easier to handle than fuel oil, plant operators would consider gas as a fuel only where it could be demonstrated that the cost of producing steam with gas was no more than from the use of oil. In other words, very few plant operators were willing to pay a premium for the fuel used in making steam. It was interesting to find that the peak usage for industrial purposes falls during July, August, September and October, as a result of the seasonal activities among canneries and fruit-

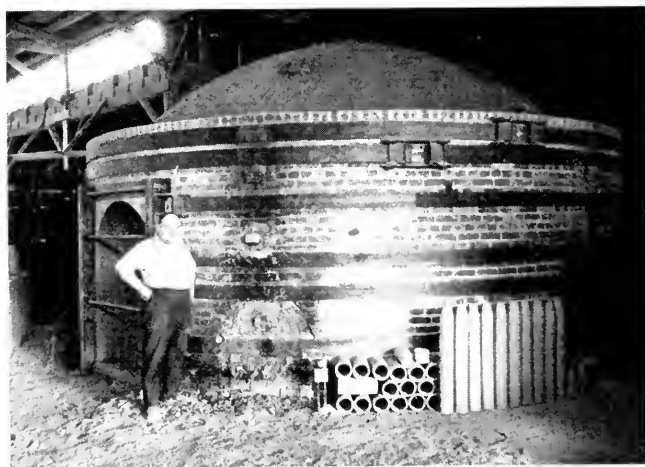


San Francisco Laundry's plant. Boiler 150 h.p.

packing plants, sugar beet factories, and others. On the other hand, the normal use of gas by domestic consumers reaches its peak in the winter, so that any business which could be secured for the summer period was very desirable.

The natural gas project, therefore, was proceeded with and duly completed. With a

large pipe line capacity available and, likewise, with a surplus of gas in the field, it was decided to endeavor to secure industrial business with a rate competitive with that of fuel oil. As an indication of the correctness of this decision, it is interesting to note that as of the first of January, 1931, 310 customers have signed contracts for an annual usage of 12,674,997,000 cubic feet. Translating this into terms of fuel oil, natural gas has been contracted for in place of 2,300,000 barrels of fuel oil being used annually. This means that



Richmond Pottery Company, Inc., San Bruno.  
Kiln for firing common flower pots.

38 per cent of the fuel oil being used industrially in the Northern California territory of the Pacific Gas and Electric Company has been changed to natural gas. Such a change in the use of fuel in less than a year and a half from the first arrival of natural gas in Northern California surely justifies the statement that in but a short time natural gas will be used in industries to the practical exclusion of all other fuels. This is further justified by the fact that the fields in the San Joaquin Valley are today producing more natural gas than is required to replace every barrel of fuel oil being used industrially in Northern California and, with the addition of compressor stations, the present pipe line system is also adequate to transport all of the gas required to displace the fuel oil.

The daily demand of 40,000,000 cubic feet required by the industries now being supplied is more than the artificial gas plant system could take care of in addition to the present domestic load and, with the installation of duplicate pipe-lines from the gas fields, it is probable that the gas plants which formerly supplied the requirements of the territory will not be operated again except in case of a major catastrophe.

Comment on the various major industries that have adopted natural gas as a fuel will serve to illustrate how generally the change from fuel oil to natural gas is being made. In August, 1929, natural gas first arrived in San Francisco and the first industrial use made of gas was under the boilers at the Potrero Gas Plant. Soon thereafter the San Francisco Packing Corporation in San Fran-

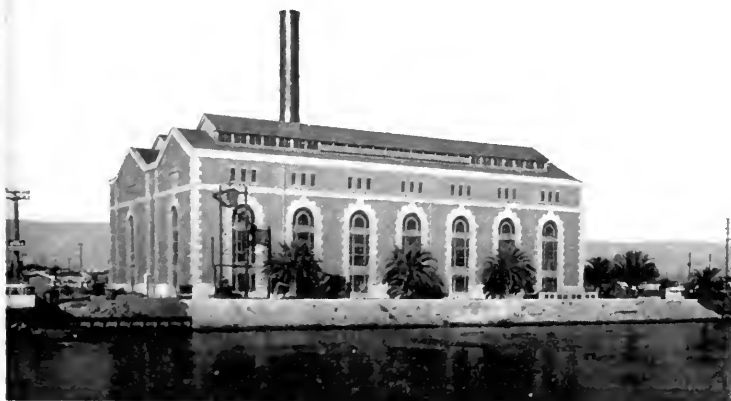


Westinghouse Electric Manufacturing Co.'s plant at Emeryville. Kilns for firing high-tension insulators.

cisco signed a contract for gas service and was the first industrial consumer to utilize the new product as a fuel in place of oil under their boilers.

Natural gas, however, was available for use in San Francisco only to the few industries immediately adjacent to the pipe-line entering the city, and it was not until about May, 1930, that it became generally available for industrial use.

As of January 1, 1931, 108 San Francisco industrial fuel-users have signed contracts for natural gas. Among the first to contract for such usage was the City Water Department, which operates four pumping plants, one at Belmont, one at Milbrae, one at Lake Merced and one on Sloat Boulevard. The four



Southern Pacific Co.'s power-house at Fruitvale, Alameda County.

plants contain 14 boilers totaling 2,450 h.p. rated capacity and represent a maximum hourly demand for gas of over 100,000 cubic feet. Among the numerous laundries in San Francisco contracting for natural gas service are the Galland Mercantile, San Francisco, Sterling, Ideal and Peoples laundries. The demands of steam in laundry work are very exacting and it has been found that natural gas as a fuel responds more readily and results in savings beyond those indicated from a study of gas versus oil on a heat-value basis alone.

Mr. George C. Klein, Vice-President of the Ideal Laundry, writes:

"By keeping a close check on the result, we have found that we are not only saving considerable on our fuel cost but, according to the boiler inspection records, our boilers are in much better condition than they were before. Natural gas keeps up the steam-pressure under all conditions.

"In summing up, we are glad to state that we consider the money spent for natural gas a very profitable investment."

A number of large hotels in San Francisco, such as the Palace, St. Francis and Sir Francis Drake, have installed gas under their boilers. Mr. T. W. Ireland, Chief Engineer at the Hotel St. Francis, states:

"The results have been very satisfactory and have fulfilled our expectations. Our fuel



Twelve 600-h.p. boilers at Southern Pacific Co's Fruitvale power-house.

costs have decreased approximately 23 per cent."

Some of the large office buildings, such as the Hunter-Dulin, Russ and Merchants Exchange Buildings, have also recognized the advantages which accrue from the use of gas under boilers, and have contracted for this service in place of the fuel oil they formerly used. The Children's Hospital, Lane Hospital, French Hospital, County Hospital and San Francisco Hospital have likewise contracted for natural gas service.

Perhaps one of the most outstanding installations of natural gas in place of fuel oil in San Francisco has been at the plant of the Illinois Pacific Coast Corporation for melting glass to be made into bottles. The various materials used in the making of glass are

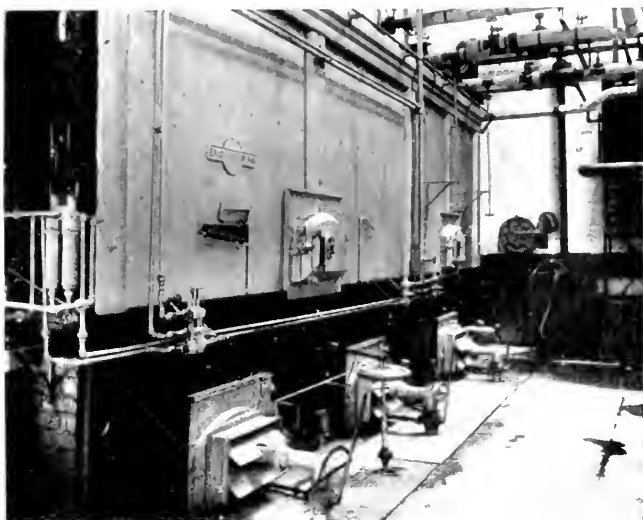
melted at a temperature of about 2500 degrees Fahrenheit in furnaces measuring 20 feet in width by 40 feet in length. The melting and making of bottles continues twenty-four hours every day throughout the year with the exception of six holidays. It is



F. E. Booth Company's plant at Centerville, Alameda County.

found that not only is there an economy in the cost of the fuel itself but production has been increased from each of the melting furnaces, or tanks as they are known in the industry. In addition to the use of gas for the actual melting of the glass it is also used in drying the sand before it is put in the furnace. The dryer is 6 feet in diameter and 30 feet in length and will dry 40 tons of sand per hour.

The Southern Pacific Company at its bayshore shops is making use of natural gas in its boiler plant and, likewise, in firing locomotives before they are sent out on their daily runs. It is a difficult matter to start a fire in the fire-box of a locomotive when there is no steam-pressure available and the fuel oil being used is cold. Considerable time is needed, therefore, before a locomotive is ready to go out. Natural gas is piped through a hose to a connection on the pipe leading to the oil-burners in the locomotive fire-box and merely by the placing of a torch in the fire-box and the turn of a valve the heating-up is begun. Depending upon the size of the locomotive, from forty minutes to an hour and a half is required, and from 10,000 to 20,000 cubic feet of gas is burned during this time in heating up the locomotive. Other representative industries in San Francisco, such as the



Boilers at F. E. Booth Co's Centerville plant.

Western Cooperage, Western Pipe and Steel Company, Western Meat Company, Marine Chemicals Company, Metal and Thermit Company, Ghirardelli Company, Golden State Company, Ltd., and the Richmond Pottery Company are making use of natural gas.

In the peninsula territory south from San Francisco are many fruit-packing plants. A number of these, including the California Co-operative Cannery, Libby, McNeill & Libby and the Greco Canning Company, use natural gas with marked success. The fruit industry, particularly in the Santa Clara Valley, also requires numerous plants that dry or dehydrate prunes. Mr. A. W. Hud-

son, Manager of the Westside Fruit Growers Association, states:

"We are pleased to add our tribute of praise to natural gas as a fuel for our dehydrating plant. For efficiency, economy and convenience, we have found it far ahead of all other fuels."

In connection with the canning



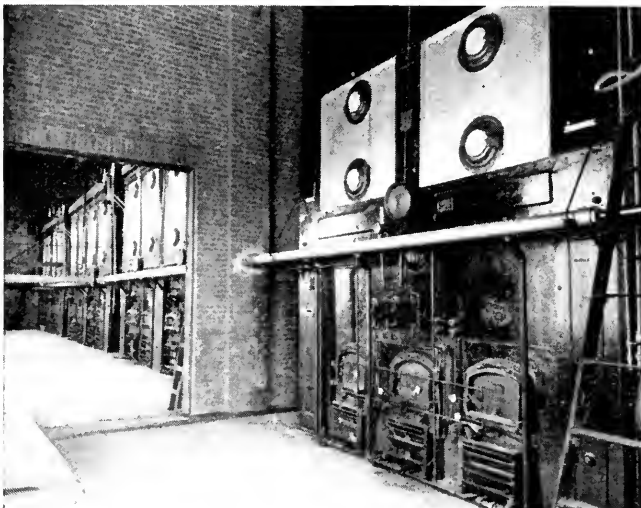
American Creamery Company's plant at Oakland.



Holly Sugar Company's plant near Tracy.

industry it is interesting to note that the California Packing Corporation, Custom House Packing Corporation, Carmel Canning Company, K. Hoven Company and Monterey Sardine Products Company, as well as practically all the other sardine canneries at Monterey, are making use of natural gas in their operations. The American Solvents & Chemical Company and the Leslie-California Salt Company likewise have replaced oil with gas. Eighty users of fuel in San Jose Division and 13 in Coast Valleys Division have displaced an aggregate annual use of 380,000 barrels of oil with natural gas.

Natural gas was available practically throughout all East Bay Division before the end of 1929 and the 89 users who have contracted for service have replaced an annual use of over 800,000 barrels of fuel oil with the new fuel. One of the largest of these users is the Southern Pacific Company at its Fruitvale power plant. Twelve 600-h.p. boilers are used to generate steam which, in turn, goes through the turbines to make electricity for the operation of the Southern Pacific electric train system. At 20-minute intervals a heavy peak demand is experienced as a result of the trains starting from the Oakland Pier.

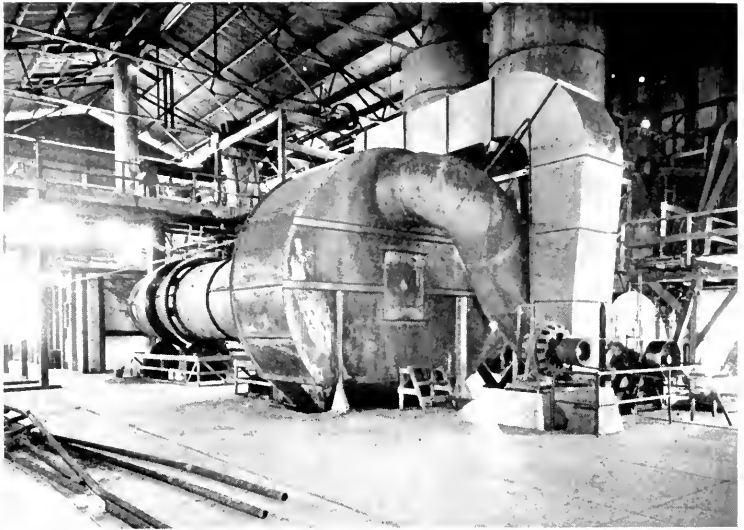


Holly Sugar Company. Boiler equipment.

Each morning and night during the rush of commuting hours, seven or more boilers are required in the plant to carry the load. From midnight until five o'clock in the morning only one boiler is required and during the middle of the day three boilers are usually ample. Needless to say the regulation of the fuel supply in from one to seven boilers, while the steam requirements of these boilers likewise vary over a wide range, presented a problem difficult of solution. However, equipment was installed which permitted regulation from a demand of only

15,000 cubic feet per hour to one as high as 270,000 cubic feet per hour. So sensitive is this equipment that fifteen seconds after the trains begin leaving the Oakland Pier the gas regulators begin opening to admit additional fuel under the boilers.

As in San Jose Division so, likewise, in East Bay Division, there are a great number of canneries. The F. E. Booth Company at Centerville, the California Co-operative Producers, California Conserving Company and Cutler-Lobingier Packing Company are among those that have found the use of natural gas desirable in place of fuel oil. With few exceptions practically all industrial operations are carried on only during the daylight hours. However, there is one use of fuel in what may be termed an industry which is peculiarly desirable from a utility viewpoint. It has been found that greenhouses and nurseries make use of fuel largely during the night hours only. The Contra Costa Nursery, Domoto Brothers and the Great Western Farms Company in East Bay Division have found that the use of



Holly Sugar Company. Beet-pulp drier. Burners having maximum capacity of 48,000 cubic feet per hour required to supply necessary heat.

natural gas in place of fuel oil gives better insurance of an adequate supply of heat to protect the fine flowers which are grown under glass and shipped in carload lots to Eastern markets. Just as the Southern Pacific Company at its bayshore shops has found natural gas for firing locomotives particularly efficient, so has the Santa Fe Railroad at Richmond adopted gas for the same purpose. At Richmond, too, there is located the Standard Sanitary Company, which uses gas for firing its enormous tunnel kilns in producing porcelain and, likewise, for firing enamelling ovens and numerous other operations. The Kraftile Company and the Westinghouse

Electric and Manufacturing Company, porcelain division, are also representative users of natural gas in the ceramic industry. The East Bay Creamery, American Creamery Company and the Darigold Creamery in Oakland have adopted natural gas for fuel.

Natural gas service available

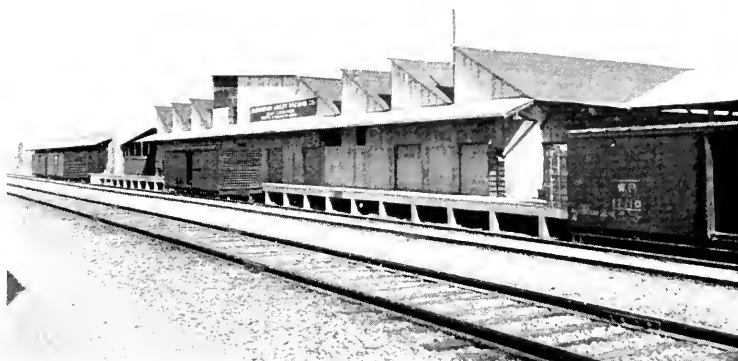


Dairymaid Creameries, Inc., plant at Tracy.

for industries throughout Northern California at prices which are very attractive is expected to be a decided factor in the growing tendency of industrial and manufacturing concerns to establish their plants and factories away from the larger and popular cities in locations more suited to their purposes.

Not only may industrial sites be purchased or leased at lower prices but the plants may be located near the sources of their raw products. The location of factories in smaller communities results also in greater contentment among employees because of the easy home-owning possibilities in close proximity to their work. Interior sections of the "Pacific Service" territory have already benefited and are expected to benefit to a very much greater extent in the near future by reason of this departure from the old order of things.

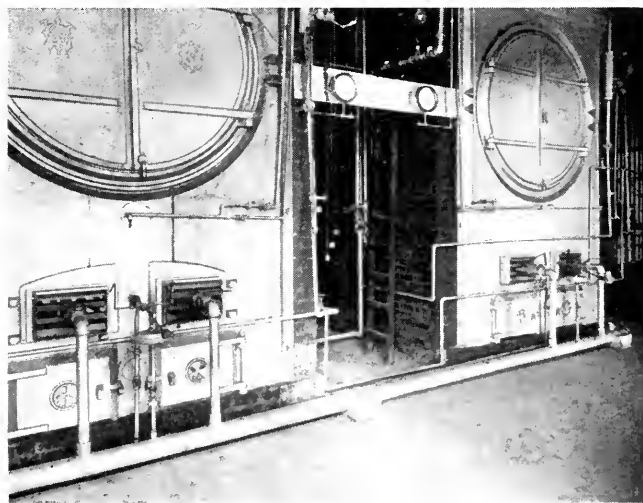
Although natural gas was not available in the Sacramento, North Bay and San Joaquin Divisions until the year 1930 was well advanced, these sections of our company's terri-



Sacramento Valley Packing Co's plant at Thornton.

tory have already marked progress. Taking San Joaquin Division as an instance, a veritable network of natural gas transmission and distribution lines serves practically every town in the area comprising Stanislaus and San Joaquin counties. Not only have many industries within or adjacent to the big towns converted their boilers to the use of natural gas, but plants located far afield from the towns' boundaries are also being served by the new fuel.

Perhaps the most noteworthy among the latter class is the plant of the Holly Sugar Corporation located about three miles north of Tracy. This plant manufactures sugar from sugar beets. The plant itself represents an investment of over \$2,000,000. It has a slicing capacity of 1,300 tons of beets in 24 hours. Its capacity in sugar production is 400,000 pounds per 24-hour day; its annual production at present is 50,000,000 pounds. Operation expenditures in San Joaquin County amount to nearly \$3,000,000 annually. This plant has 2,240 h.p. in boilers and approximately 1,200 h.p. in driers, all fired with natural gas. The gas input during peak operation of the plant is approximately 3,750,000 cubic feet per day.



Sacramento Valley Packing Co. Boiler room at the plant.

Another thriving industry converted to the new



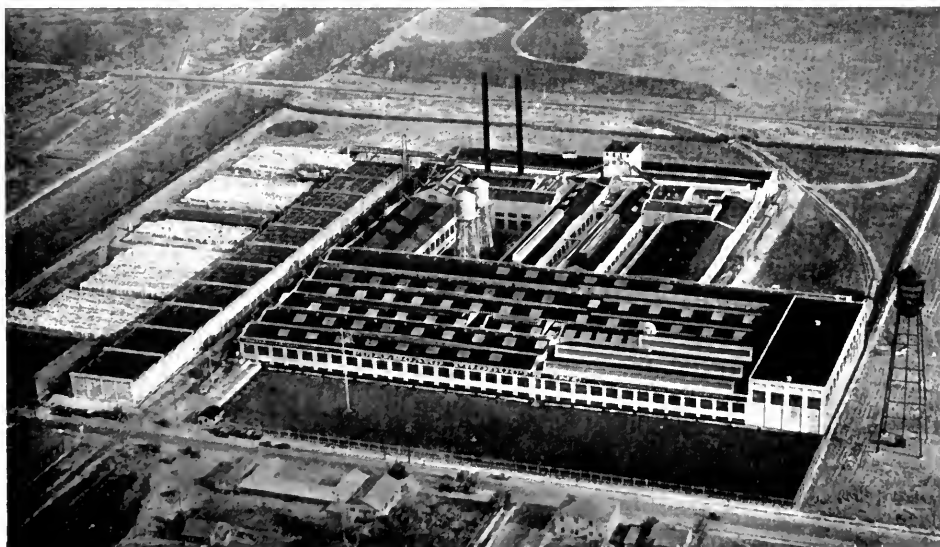
Sun Garden Canning Company's plant near Modesto.

fuel is the Sun Garden Canning Company, whose plant is located in the heart of the peach and apricot district about four miles north of Modesto. In 1930 this plant canned over 750 tons of apricots and 2,500 tons of peaches. The season's run was finished with tomatoes, over 8,000 tons of which were handled. At present the plant has 500 h.p. boiler capacity installed, fired with natural gas. Plans are being made which will increase this installation by an additional 300 h.p. in time for the 1931 season.

The D. Caso Cheese factory at Newman has recently been served with natural gas.

The Caso plant is one of the largest cheese manufacturies in this part of the State. Nearly 50,000 pounds of raw whole milk are received daily, and about 6,000 pounds of cheese of various types manufactured.

At Hughson, situated eleven miles southeast of Modesto, the Hughson Condensed Milk Company is located. The plant employs about fifty people. It receives on an average of about 140,000 pounds of raw milk daily which is converted by various processes into the following products: sweet cream, ice cream mix, condensed skim milk and powdered skim milk. The finished products are



Airplane view of Fibreboard Products Company's plant at Stockton.

then shipped to the eager markets in the larger cities where there is a daily increasing demand for pure dairy produce. The company is preparing to fire its three boilers, aggregating 550 h.p., with natural gas.

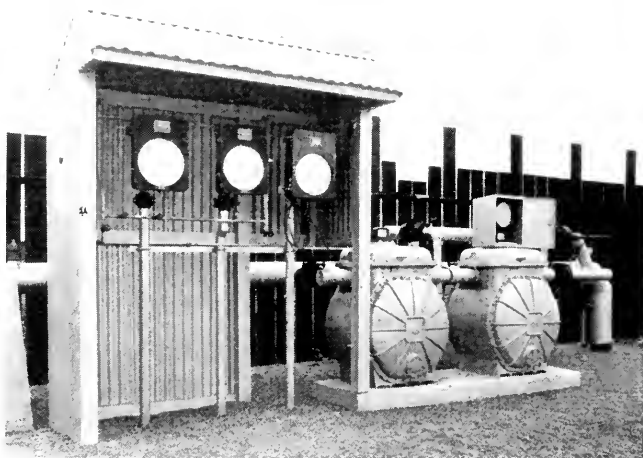
Another large plant in Modesto is that of the Milk Producers Association of Central California. This is a dairymen's co-operative association and enjoys the distinction of being the largest of its kind in existence. Over 2700 dairymen in the territory lying between Galt on the north and the Merced River on the south are members. The association has an annual payroll of approximately \$350,000, and does an annual business totaling nearly \$5,000,000.

About 370,000 pounds of whole milk are received daily. At the present time the output is about 7,000,000 pounds of butter per year. This plant is preparing to fire its eight 150-h.p. boilers with natural gas.

The Sacramento Valley Packing Company's plant at Thornton, north of Stockton, enjoys the distinction of being the first cannery in this region to convert its boilers to the use of natural gas. This cannery belongs to the W. P. Hammon estate, having been established as an outlet for the products of its ranch holdings. During the 1930 season this plant packed 600,000 cans of spinach, 288,000 cans of apricots, 4,000,000 cans of peaches and 2,400,000 cans of tomatoes. Approximately 500 people are employed at the cannery during the active canning season.

The largest individual industrial consumer in San Joaquin Division, however, is the Fibreboard Products Company, with its plant at Stockton. Its requirements run about 3,000,000 cubic feet of gas per day throughout the year. The boiler installation comprises four units of an aggregate capacity of 2,926 horsepower.

In addition to nearly all the major indus-



Gas meter installation at the Fibreboard Products Company's plant at Stockton. Typical installation of the large meters required to accurately measure industrial loads.

trial concerns in the northern part of the San Joaquin Valley, many small towns are now being served with natural gas that heretofore enjoyed no gas service at all. The cost of building gas-manufacturing plants, taken together with the high cost of distribution in sparsely settled areas, would have made rates almost prohibitive. The coming of natural gas into this territory has made available this cheap, clean, convenient fuel for many domestic purposes. Principally the gas is utilized for cooking, water-heating and house-heating. Commercial establishments such as laundries, restaurants, bakeries, etc., are also finding this new fuel economical and efficient.

It is hardly necessary to say that while the representative plants mentioned do not perhaps represent every type of industry being served with natural gas in the "Pacific Service" territory, they are illustrative of the substantial nature of the concerns that have early recognized that the new fuel presents an opportunity for economies of industrial operation and improvement of products such as has never before been available. Natural gas service is undoubtedly the most outstanding contribution towards the development of Northern California that the Pacific Gas and Electric Company has ever made.



# Our Company's Service Groups— A City Block in San Francisco

By PAUL E. CHAPMAN, *Division Superintendent Electric Department,  
San Francisco Division*

The necessity for adequate garage, warehouse, shop and yard facilities for the San Francisco Division was a natural outgrowth of the steady expansion of the company's gas and electric operations in San Francisco, whereby the old quarters situated at Fifth and Howard Streets became hopelessly inadequate. Anticipating this condition, and after years of careful study and planning, it was deemed advisable to acquire new property of sufficient size and in a location suitable for present and reasonable future requirements. A highly satisfactory solution of the problem was initiated by the acquisition of the Hind property located in the Mission district and bounded by Eighteenth, Nineteenth, Shotwell and Folsom Streets, taking up an entire city block. The selection of this site for a centralized service group has proven very desirable not only because of the excellent arrangement and type of buildings and plant, but because of the ideal climatic conditions, the property lying within the limits of the so-called warm belt of the Mission district.

It has a linear dimension east and west of

245 feet and north and south of 520 feet. The property at the time it was purchased contained a small steam plant, several concrete buildings and a number of old flats. As the tenants of some of the buildings held leases on the premises they occupied, the steam plant was kept in operation until November, 1929. In the meantime the Engineering Department laid out complete plans, and upon approval of them by the management active work started in the demolition of the flats and the power-plant. The garage and gas meter shop were the first buildings erected. Work was well under way on the entire project when the merger of the Great Western Power Company and its affiliated companies with the Pacific Gas and Electric Company took place. Rearrangements were made in the office building which caused a short delay in the completion of the project, but in the end proved an advantage under the new conditions.

The service group consists in general of a block of property on which have been erected a new garage, a gas meter shop and a trans-

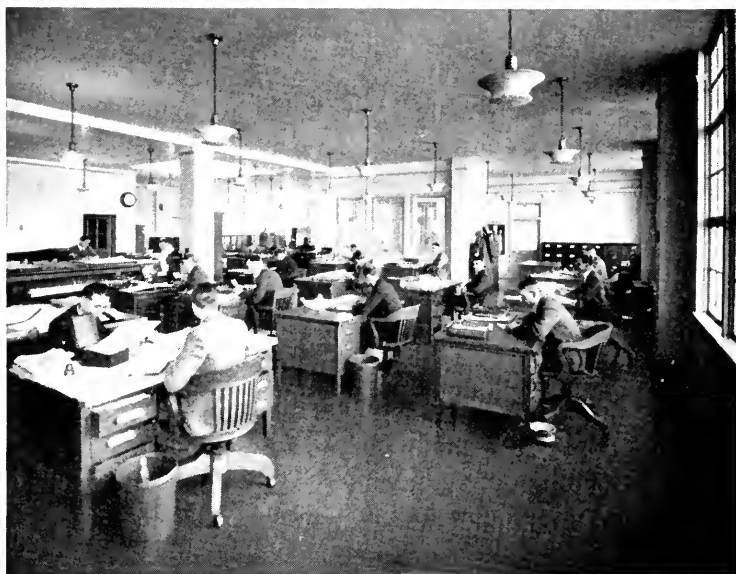


Our company's service group in San Francisco occupies an entire city block.

former shop. Two existing buildings were reconstructed, one into a warehouse, the other into an electric meter shop and office building, for the operating personnel of the gas and electric departments. The space not occupied by buildings serves as a yard in which are stored pipe for the gas department, and cable street-light standards and other large materials for the electric department. A spur track enters the block

from Eighteenth Street connecting with the main line on Harrison Street. The yard is enclosed by a concrete fence with the necessary driveways protected by adequate gates.

In the southeast corner, at eighteenth and Shotwell, in a reconstructed concrete building is located the organization that directs the operation of all the gas, electric and steam properties of the division. The entrance is from Eighteenth Street into an attractive



Office of the electric department, second floor.

lobby flanked on the right by the branch office, on the left by the service and meter department. An assembly room which will accommodate approximately 150 people is located on this floor, entrance to which is from the main lobby or from the street. Oak finish is used throughout the main hall and branch office. Attractive accommodations have been made in the office for service to the public in paying bills.



Electric meter shop.

Direct entrance to the office of the service and meter department is from the main lobby. This office houses the superintendent of the department, his aides and clerical force. The floor space is divided among four rooms, office, test room, repair shop and storage room. In the office are the files containing 216,000 meter history cards of the electric department, test records, meters, and service records of demand meter installations and power loads. Testing of all types of electric meters, both A. C. and D. C. current, potential transformers and relays used on

the new network protectors which are now being installed in certain sections of our underground territory is done in the test room.

The balance of the first floor is given over to the transformer shop. Minor repairs to the transformers used in the San Francisco Division are made here. To handle this class of work, and to facilitate the receiving, storage and loading of transformers, a traveling hoist which could



Transformer shop, on the first floor.

cover the entire area of the shop was installed. A complete system of oil-storage and a system for the reclamation of oil have been installed, the tanks of which are buried in the yard at the end of the building. In the transformer shop is located the main switchboard for the office building. On this floor is also located the gas-fired steam-heat and hot-

water plant which supplies hot water to the building and 24-hour steam service to the complaint room directly above. The balance of the building receives its steam heat from a centrally located steam heating plant under the gas meter shop.

The mezzanine floor contains a commodious stationery room where all the stationery

for the electric and gas departments is stored. The corner section of the mezzanine floor has been converted into several rooms for the use of the women of the building. A rest-room, dining room, fully equipped kitchenette, lavatory and hall compose the group. Attractive decorations, with their sunny exposure, make the rooms most desirable.



Office of the gas department, second floor.

On the top floor of the building

are found the offices of the electric and gas departments and the private telephone exchange for the entire service group. The floor space in the electric office is assigned to the clerical, estimating, maps and records departments and to the supervisory force of the operating department. A well-equipped blueprint room, cloak room and lavatory occupy the balance of the space. The entire gas and electric office is flooded with light and is equipped with the latest automatic ventilating and steam-heating system. A fine system of communication by the dictagraph has been installed between the various departments in the building. The Shotwell Street side of the gas department space is occupied by the offices of the division superintendent and the superintendent of the service department. The supervising organization and clerical force occupy the major portion of the space. There is a room at the easterly end of the building devoted to gas and electric complaint work.

It has been the policy of the company to receive all telephone calls from the public



Gas-meter shop. All repairs done here.

through the Market Street exchange, routing those concerning the Division to 445 Sutter Street where complaints of all nature are handled by what is known as the service board. The complaints of a physical nature, that is, those concerning the gas, electric and steam services, were phoned to the physical department and later followed by complaint tags. To speed up the receipt of complaints at the combination gas and electric complaint desk located in the new service group, a teletype system has been installed between 445 Sutter Street and Eighteenth and Shotwell. As the complaints are received via 245 Market Street to 445 Sutter Street they are segregated, and those concerning the physical department are immediately sent over the

teletype, resulting in quicker service to the party making the complaint.

On the southerly end of the property is located the new garage building. It is a three-story and basement reinforced concrete structure occupying the entire Nineteenth Street front and extending to a depth of 148 feet on Folsom Street. En-



Garage. This accommodates over 400 machines.

trance to the building is by means of ramps extending to the different floors from the three street frontages. Entrance to the yard is from the first floor. From Folsom Street it is possible to enter either the basement or the first floor. From Nineteenth Street entrance to the first floor is also available, while on Shotwell Street ramps extend to the second and third floors of the building. Storage is provided for automobiles in the basement, first and second floors.

The third floor is used for the garage shops, that is, the automotive, machine and upholstery shops. The superintendent's office is located on this floor, also the tire-shop and battery-charging room.

The construction of the new garage building allowed many new and unique features to be incorporated. As an illustration, from the third floor entrance is had to the roof over the gas meter shop, which space has been converted into an outdoor testing shop. Here the company's automobiles can be actually tested without allowing any inconvenience to the man doing the job from exhaust gases, as the entire roof space is open. On fine days the outdoor shop is used to make adjustments of a minor nature on the cars under running conditions. The men work under extremely favorable conditions on jobs



Carpenter shop, on the third floor of the garage building.

of this nature as they are working in the daylight and in the open air. The paint shop occupies a small section of the roof area where all existing hazards in spraying lacquer have been eliminated.

The garage shop is ventilated by mechanical means. Wood-block flooring is used in some of the shops. Up-to-date labor-saving devices have been installed in the machine and carpenter shops, all of which are equipped with individual motor drive. The tire-repair shop has been equipped with the latest methods of repairing automobile tires. Retread moulds, vulcanizers, testing tanks and other essentials for this class of work are installed here.

Considerable thought was given to the proper lighting of the garage so that all floors are thoroughly equipped with the latest type of non-glare lamps and fixtures. Lighting intensities are up to the modern standards for this class of work.

In order to aid in keeping down the labor turnover to a minimum, comfortable quarters have been established, which are warm, clean and cheerful, and which consist of recreation, locker and wash rooms. Each employee has his respective locker and adequate washing fa-



Garage machine shop, third floor.

cilities are provided.

On the first and second floors of the garage are located the car wash-racks. These racks have been laid out with the idea of minimizing all unnecessary operations and reducing the time of washing a car to the absolute minimum. Four guns capable of producing a pressure spray are available for instant use. The complete unit occupies one corner of the wash-rack and is connected to a water supply which receives water from a well located on the premises. Special types of covers and gratings over the drains are used, so that the hazard of washers slipping on these gratings or tripping and falling is practically eliminated.

Natural gas is used in the forges of the blacksmith shop and, also, in the machine shop, for all annealing and case hardening.

As the cars enter the garage at night their gasoline tanks are filled from the pumps located at the different ramps in the building. Each pump draws from two 550-gallon un-



Interior of warehouse.

derground storage tanks. The gasoline passes through a volumetric displacement meter where all gasoline is accurately measured at a maximum pumping rate of twenty gallons a minute. The method of operating is quite simple and speedy. A vehicle pulls up to the dispensers located at each ramp in the garage, the driver opens his gas tank and the checker at the gas pump delivers the gasoline to the vehicle. Fire hazard is reduced in this way and there is considerable reduction in labor over the old method. Approximately 165 cars receive their gasoline on returning to the garage at night over an elapsed time of fifteen minutes.



The company maintains a branch office at the corner of Eighteenth and Shotwell Streets.

Occupying 143 feet on Shotwell Street and adjoining the garage is a two-story reinforced concrete structure, the upper floor of which houses the gas-meter shop. The lower floor is partly used for the distribution of gas meters, while the balance of the space is given over to the storage of material and for the steam-heating plant of the service group. The gas-meter

shop is designed to handle 55,000 gas meters per year when operating at full capacity. Bench space for 46 workers is provided along the Shotwell Street side of the building. There are ten provers in rooms located in the center of the shop, but the rooms are so segregated and constructed that an even temperature is maintained by electric heaters, the temperature of which is independent of the temperature of the balance of the shop. The main shop is ventilated by a well-designed blower system, so that the airiness of the shop is immediately noticeable upon entrance to it. Wood-block floors are used throughout the entire shop, which adds greatly to the comfort of the workmen. Locker rooms and wash-rooms are provided for the men on each floor.

On the Folsom Street side, midway between Eighteenth and Nineteenth Streets, is located the warehouse. This is a one-story reinforced-concrete building covering 222 feet on Folsom Street with a depth of 110 feet. All small material is stored in this building, the larger articles being stored in the yard or in the space under the gas-meter shop. On the yard side, running practically the length of the building, a metal counter has been installed, arranged in three parts for convenience in handling material, one part for electric, one for gas and one for appliances. Steel bins have been constructed at the rear of this counter, also underneath it. At the south end are located the bins for material supplied to the overhead line trucks. The warehouse has adequate office space, plenty of light and is well ventilated. It is so arranged that incoming material other than that which comes in by carload lots is received on the Folsom Street side and dispatched on the yard side. Rooms have been provided for the storing of cross-arms and street-lighting brackets. A room has been provided for the storage of cement. This room is located so that when a car has been spotted on the spur track opposite its entrance the entire carload of cement can be unloaded in four hours' time. Under the old arrangement it required practically two days' time to unload a carload of cement and transport it to the Howard Street yard. The spur track which enters the yard permits much saving of time, in that cars loaded with pipe can be placed on the track opposite the place where the pipe is to be unloaded and by means of skids the entire load of pipe can be rolled into place in the yard. Time is saved

also in the unloading of reels of cable. By the use of the Gantry crane, which has a capacity of five tons, the reels of cable can be unloaded directly from cars to their position in the yard with only one handling. Under the old way of operating it was necessary to first unload the reels from the car to a truck and then transport the cable to the yard, where another operation was necessary to unload the reels. By means of cars routed over this spur track it is much easier to handle material that is received from Emeryville, or material that is taken from the yard to Emeryville.

With the garage and warehouse practically one unit, in that one building is adjacent to the other and connected by passageways, the practice of night loading of trucks, service trucks and meter cars has been inaugurated. By loading these automobiles at night it is possible for the drivers to go to the garage and find their cars loaded with material, gassed and serviced, so all that is necessary for the driver to do is to get his machine out of the garage and on the job.

The original service group committee consisted of Mr. P. M. Downing, now First Vice-President and General Manager; Mr. W. S. Yard, Vice-President in Charge of Gas Construction and Operation; and Mr. F. P. Hanson, Superintendent of the Supply Department. During the construction of the service group, Mr. F. R. George, Engineer of Electrical Operation, was placed on the committee.

The Engineering Department, Mr. A. H. Markwart, Vice-President in Charge, was responsible for the preparation of the plans and supervision of the construction of the entire project. The work was handled by Messrs. R. I. Meyerholz and I. C. Frickstad, under the general direction of Mr. I. C. Steele, Chief of Division of Civil Engineering. Mr. Meyerholz attended to the many engineering features and designs, and supervised the work from its inception to its completion. Mr. Frickstad was responsible for the architectural features. Mr. F. M. Harris was responsible for the preparation of specifications and negotiations with the Purchasing Department. Credit for the job is due not only to the above-mentioned men, but to the numerous individuals in various departments of the company, whose earnest efforts were in a large way responsible for the excellent results obtained.

## The Financial Side of "Pacific Service"

The Company's independent auditors, Messrs. Haskins & Sells, are now engaged in their audit of our accounts for the year 1930. The final statement of income account is therefore not available at the time of going to press, but full details of the Company's operations last year, together with a copy of certified balance sheet at December 31, 1930, will be contained in annual reports which will be mailed to stockholders prior to the annual meeting on April 14.

### ADDITIONAL OFFERING OF COMMON STOCK RIGHTS

The Company's common stockholders of record at the close of business on January 26, 1931, were offered the right to subscribe, at its par value of \$25.00 per share, for one new share of common stock for each ten shares owned on that date.

This offering, which is designated "Par Offering No. 6," was made in conformity with the policy announced by the Company slightly more than five years ago of obtaining a portion of its new capital requirements from the sale, at par, of common stock at approximately annual intervals through the issuance of rights to its common stockholders. That this program has been consistently carried out is indicated by the following record of past offerings:

PAR OFFERING No.	RECORD DATE	% OF OFFERING SUBSCRIBED
1	Feb. 23, 1926	98.32%
2	Jan. 26, 1927	98.72
3	Feb. 17, 1928	99.52
4	Feb. 8, 1929	99.70
5	Sept. 25, 1929	99.70

The new offering involves the issuance of approximately \$14,185,000 par value of additional common stock.

In a letter to common stockholders outlining the details of this new subscription privilege it was stated:

"The funds derived from this offering will be applied to the cost of additional facilities to be constructed in 1931 to meet the continuing growth of the Company's business.

"Attention is directed to the earnings statement on the last page of this circular, covering practically the entire period during which the Company's policy of offering rights has been in effect. This statement shows not only substantial increases in gross, net, and surplus earnings from year to year but also shows that common stock dividend requirements, including dividends on the additional issues of such stock resulting from the granting of rights to common stockholders from time to time during this period, have been earned by increasing margins."

The following summary is condensed from the earnings statement above referred to:

YEAR	SURPLUS FOR COMMON STOCK	COMMON STOCK DIVIDENDS	BALANCE (UNDISTRIBUTED SURPLUS)
1926.....	\$ 5,370,360	\$4,119,970	\$1,250,390
1927.....	7,001,192	4,892,352	2,108,840
1928.....	8,800,708	5,550,574	3,250,134
1929.....	10,899,921	6,191,892	4,708,029
*12 Months to Sept. 30, 1930.....	13,531,119	8,567,479	4,963,640

\*The income statement for twelve months to September 30, 1930, includes earnings of Great Western Power Company of California, San Joaquin Light and Power Corporation and Midland Counties Public Service Corporation for only three and one-half months, these properties having been acquired as of June 12, 1930.

## SALE OF ADDITIONAL ISSUE OF FIRST AND REFUNDING MORTGAGE $4\frac{1}{2}\%$ BONDS

In conformity with authorization received from the Railroad Commission on January 10, 1931, the Company sold to The National City Company an additional issue of \$25,000,000 par value of its First and Refunding Mortgage Series "F"  $4\frac{1}{2}\%$  Bonds maturing June 1, 1960.

The proceeds from the sale of these bonds will be utilized chiefly in refunding certain bond issues of the Great Western Power Company of California and of other subsidiary companies, bearing higher interest rates. The result will be a substantial saving in annual carrying charges, and a corresponding increase in the surplus available for dividends. The remaining proceeds from the sale of the new bond issue will be used for additions and betterments to the Company's properties, as will also the funds arising from the offering of approximately \$14,185,000 of additional common stock referred to on the preceding page. The construction budget during the current year involves the expenditure of approximately \$40,000,000, assuring the continued employment of several thousand men and women throughout the year in addition to those engaged in the Company's regular operations.

## RETIREMENT OF SECURITIES OF THE GREAT WESTERN POWER COMPANY OF CALIFORNIA

Substantial progress has already been made in the Company's program of retiring outstanding securities of the Great Western Power Company of California which may be economically refunded, with a view to reducing fixed charges and also to facilitating the merger of these properties with the Pacific Gas and Electric Company's system. So far, \$24,251,400 par value of bonds of Great Western Power Company of California and its subsidiary, Feather River Power Company, have been redeemed or called for payment, as follows:

NAME OF ISSUE	MATURITY DATE	DATE OF REDEMPTION	PAR VALUE WITH PUBLIC
Great Western Power Co. of Cal. $5\frac{1}{2}\%$ Notes.....	Nov. 2, 1930	Nov. 2, 1930	\$ 4,000,000
Great Western Power Co. of Cal. Series "A" 6% Bonds	Mar. 1, 1949	Dec. 1, 1930	5,681,900
Feather River Power Co. First Mortgage 6% Bonds.....	Serial	Jan. 1, 1931	5,399,000
Great Western Power Co. of Cal. First and Refunding Mortgage Series "D" $5\frac{1}{2}\%$ Bonds.....	Feb. 1, 1955	Apr. 1, 1931	9,170,500
Total.....			\$24,251,400

The foregoing bonds, together with certain additional issues subsequently to be called for redemption, have been or will be retired with cash advanced by the Pacific Gas and Electric Company and derived from the sale of its own First and Refunding Mortgage  $4\frac{1}{2}\%$  Bonds.

In furtherance of its plan to retire all of the Great Western Power Company's stock outstanding in the hands of the public, the Pacific Company is offering to exchange its own preferred stock for that of the Great Western Company on the basis of two \$25.00 shares of Pacific Gas and Electric Company 6% stock and two \$25.00 shares of its  $5\frac{1}{2}\%$  preferred stock for each \$100.00 share of the preferred stock of the Great Western Company. A circular letter outlining the terms of this offer was mailed to preferred stockholders of the latter company the 30th day of January and, judging from the amount of stock already turned in, will meet with general acceptance on the part of Great Western stockholders.

An exchange offer will also be made in the immediate future to preferred stockholders of Feather River Power Company. All outstanding bonds have already been retired and it is planned to wind up the affairs of this company as soon as possible.

## OTHER BOND ISSUES RETIRED

The following additional bond issues have also been called for payment:

NAME OF ISSUE	MATURITY DATE	DATE OF REDEMPTION	PAR VALUE WITH PUBLIC
Modesto Gas Company First Mortgage 6% Bonds.....	Jan. 1, 1945	Jan. 1, 1931	\$ 152,000
Yuba River Power Co. First Mortgage 6% Bonds.....	Serial	Apr. 1, 1931	994,000
Total.....			\$1,146,000

# Pacific Service Magazine

PUBLISHED QUARTERLY IN THE INTERESTS OF  
PACIFIC GAS AND ELECTRIC COMPANY

FREDERICK S. MYRTLE - EDITOR-IN-CHIEF

PACIFIC GAS AND ELECTRIC COMPANY  
245 Market St., San Francisco

*The Pacific Gas and Electric Company desires to serve its patrons in the best possible manner. Any consumer not satisfied with his service will confer a favor upon the management by taking the matter up with the division headquarters.*

VOL. XVIII JANUARY, 1931 No. 3

During the year just past the Pacific Gas and Electric Company recorded the twenty-fifth anniversary of its incorporation.

It was in October, 1905, that through a merger of the California Gas and Electric Corporation, a combination of light and power enterprises covering the greater portion of central California, with the San Francisco Gas and Electric Company, "Pacific Service" sprang into being. The consolidated organization, through its various predecessors in interest, dated back to the days of pioneer enterprise, to the days of initial experiment in the way of construction and service that in the course of years developed into the great public utility structure of the present day. Among the pioneer achievements that had blazed the trail, so to speak, were included the construction of the first central station in the world for the generation and distribution of electric light and power throughout a city; the first experiments in rural electrification; the first electric transmission construction at 60,000 volts; the first establishment of a complete central load-dispatching system; the establishment of the first gas service in the State of California; the first high-pressure gas transmission.

Pacific Gas and Electric Company, then, may be said to have had a fair start. But it was not all plain sailing from then on. On the electric side, rural electrification took some years to develop into its present almost universal application to the farming industry; irrigation and reclamation projects were slow to avail themselves of the power that was at their disposal and which in the course of time proved the salvation of the Delta section of the territory watered by the Sacramento and San Joaquin rivers. Gas was for many years used almost exclusively as an

illuminant and for domestic cooking, and its general acceptance as the ideal fuel for industrial enterprise has been the result of a very gradual upbuilding. But, the seeds of public utility service had been sown in healthy soil, and but time and attention were needed for them to sprout into a luxuriant growth, whose products now nourish every form of activity that makes for development and progress in our beloved State of California, to say nothing of their contribution to modern domestic comfort and economy.

The first year was an eventful one. The properties included in the combine were formally taken over in January, 1906, and three months later disaster fell upon the city of San Francisco. Gas mains were broken, the water supply was cut off, power lines were down and there was chaos everywhere. That was the time for our company's engineers to prove their mettle, and nobly they responded to the call. In an incredibly short space of time, measured by hours rather than days, gas and electric services were restored and the people enjoyed those comforts as a foundation for their work of rehabilitation. From that time on and following its financial reorganization in 1907, Pacific Gas and Electric Company proceeded upon its upward career without serious setback.

As the years rolled on, new properties were acquired and the "Pacific Service" territory extended. Interconnection of high-tension electric transmission lines, which previous to 1918 had been confined to the territory covered by the company's operations, linked the power interests in one comprehensive chain that proved of extraordinary benefit to consumers as well as to the industry. Interconnection, while accomplished without affecting the individual identities of the various companies serving different sections of the State, has been effective in enabling the power utilities as a whole to utilize to the utmost advantage the various sources of power supply within their control; to so regulate the power output as to provide against regional shortages in supply of electric energy due to climatic and other conditions; to satisfy extraordinary demands for power whenever and wherever presented; to meet operating emergencies of any kind, in fact, and so insure to all sections of the territory covered by their combined operations a continuous and dependable service adequate to their several needs. It has been equally effective in enabling economies of operation,

with resultant benefit to consumers in reduced rates.

On the gas side, just two years ago our company started work upon a project whose completion has been among the most important constructional achievements of its history, measured by the radical benefits it has conferred upon consumers, both domestic and industrial. Natural gas was conveyed by high-pressure from the San Joaquin Valley oil fields a distance of 250 miles to the bay of San Francisco, with branch service lines into the interior on all sides. It is now being served to consumers in the greater portion of the "Pacific Service" territory. This proved a record job, involving the construction of a 750-mile network of natural gas transmission pipe lines, covering the greater part of northern and central California, within a period of one year and nine months. It represented a capital investment of, in round figures, \$27,000,000, and through interconnection with the very extensive distribution facilities already existing has resulted in the displacement within its area of artificial gas as a commodity by a cheap and reliable fuel whose heating value is about double that of the manufactured product.

The success of this project is recorded in the expressions of satisfaction that come from all parts of the territory involved. Gas bills have been cut almost in half and the heating quality of the new product found to be all that was claimed for it. The manufacturing industry, far and wide, is calling for it and large industrial establishments are scrapping their heating systems and availing themselves of the opportunity to make use of a fuel that is efficient, easy to handle and whose supply is practically unlimited.

On the financial side, the year 1914 stands out from all others by reason of the fact that in June of that year Mr. A. F. Hockenbeamer, at that time Treasurer and now President of the company, conceived and carried out the policy of "customer ownership" which has since been followed by all the major public utilities of the country. An issue of \$12,500,000 first preferred 6 per cent stock was sold over the counter to stockholders, consumers and employees at a price of \$82.50 a share, at a selling cost to the company of one-half of one per cent. Coming at a time of unusual financial stress, when the market for investment securities was virtually at a standstill, this seemed indeed a hazardous experiment. But, it caught on, and

the success of this selling campaign placed not only our company but other public utilities that followed its example upon an entirely new and independent financial footing.

Just about the time this initial experiment in customer ownership had reached a successful conclusion Mr. Cyrus Peirce, head of one of the leading investment houses of the Pacific Coast, had occasion to appear as a witness at a hearing before the California Railroad Commission. Replying to a question asked by the presiding commissioner, Mr. Peirce said: "We do not sell preferred stocks. In fact, nobody that I know of is selling preferred stock just now. The only recent transaction of the kind I know anything about is the amazing operation of the Pacific Gas and Electric Company which has excited the wonder of the whole financial world."

To quote the words of a financial news writer of that time, "A new trail was blazed in the jungle of finance." The degree to which this trail has since been traveled by public service corporations throughout the United States may be realized from the statement that in the sixteen years following this Company's initial campaign, the electric light and power companies of the country sold by this means alone more than twenty million shares of stock to two million purchasers.

Mention has been made of new properties acquired, from time to time, during the twenty-five years that have rolled by since Pacific Gas and Electric Company was incorporated. Among the utilities operating in northern and central California whose systems have been merged with that of "Pacific Service" may be mentioned the Northern California Power, Oro Electric, Sierra and San Francisco, Western States Gas and Electric, Coast Valleys Gas and Electric, California Telephone and Light, Snow Mountain Power Company and, within the past year, the Great Western Power Company, San Joaquin Light and Power Corporation and the Midland Counties Public Service Corporation, with their subsidiaries. "Pacific Service" is now recorded as not only the largest gas and electric company in the State, but, also, among the three largest operating utilities of its kind in the United States, with assets of approximately \$670,000,000, gross revenues estimated to exceed \$87,000,000 annually, serving upwards of 1,200,000 customers, its field of operation a territory about 85,000 square miles in extent.

Business building is the keynote of the Pacific Gas and Electric Company's sales program for 1931.

Organized effort of a united gas and electric industry is the basic principle of the program. Three distinct units will co-operate for better business: the P. G. and E. sales force, the general personnel of the company, and the dealers, jobbers and manufacturers associated in the industry. "

Five hundred P. G. and E. salesmen constitute the Sales Department's force for the coming year. In addition to these, the company will have its entire personnel taking an active part in selling gas and electric service. Special awards are offered in all divisions for employee participation.

Sales activities of the company will tie in closely with sales activities of dealers, jobbers and manufacturers of the electric and gas industry in Northern California. Plans for increased dealer co-operation are an outstanding feature of the sales program. Total business to be developed for the electrical contractor and dealer through this united effort is estimated conservatively at \$8,359,000. Sales of gas appliances and materials are expected to amount to \$7,675,000.

Plans for this extensive development of new gas and electric business call for an estimated expenditure of approximately \$1,500,000 in Pacific Gas and Electric Company sales activities.

Sales quotas for both gas and electricity are substantially greater than 1930 objectives. With the new natural gas proving a revolutionary success for both domestic and industrial purposes, gains in the use of this fuel are expected to exceed those of the high introductory year. An increased revenue of \$44,460,000 is expected to be attained by natural gas sales in 1931. Electric sales are expected to result in a gain of 318,000 horsepower in connected load.

An ambitious program for the development of all classes of business has been outlined by the Gas Sales Department. The gas range quota of total sales for dealers and the P. G. and E. is 25,000, and the automatic water-heater quota is 12,000. Domestic gas-heating is one of the largest fields of potential sales development. During 1929, the year previous to the bringing in of natural gas, 80 per cent of furnace sales were gas. A greatly increased number of gas-heating installations is anticipated for 1931, a quota of 5,500 natural gas furnaces and

boilers comparing with 3,500 sold last year. It is estimated that 15,000 small gas-heating appliances, including floor-furnaces, will be sold this year, compared with 7,500 during 1930.

Natural gas for commercial heating has proved immensely popular, and it is estimated that 1,800 new installations for building-heating and similar uses will be made during 1931. The P. G. and E. will have 49 salesmen working on this business.

During 1930 one-third of the oil used in industrial boilers was displaced with natural gas. It is expected that approximately 300 industrial boiler installations will be converted to natural gas this year and that 400 industrial jobs of other types will be sold natural gas equipment.

Domestic lighting and appliances and commercial and industrial power are the two new business classifications in which electric sales are expected to be greatest, the quota for each of these classes amounting to approximately 130,000 horsepower. Domestic appliance quotas for dealer and company electric sales are: ranges, 6,000; water-heaters, 2,500; major air heaters, 2,500; auxiliary air-heaters, 10,000; floor and table lamps, 20,000; cookers, 8,000.

A total market for the electrical industry amounting to \$32,893,000 is estimated to be the result of P. G. and E. activities this year. This figure includes the company expenditures for transformers, meters and other materials for new business distribution requirements, the value of current-consuming equipment, the value of contractors' wiring materials and the cost of materials to be purchased for major electric construction projects outlined in the Pacific Gas and Electric Company's budget for 1931.

Under the terms of a contract to supply power to the Shell Chemical Company's plant at Pittsburgh, Contra Costa County, our company has just completed construction of an out-door high-tension substation, of the industrial type, at the plant. This station will be operated by the Shell Company under lease from "Pacific Service." Its present rating in installed transformer capacity is 8,000 horsepower and this is subject to very material increase as the operating company's requirements shall warrant. Power is already available from the P. G. & E. high-tension transmission lines running between South Tower, on Carquinez Strait, and the Contra Costa substation near Antioch.

# PACIFIC GAS AND ELECTRIC COMPANY

A CALIFORNIA CORPORATION

Managed by Californians

Operated by Californians

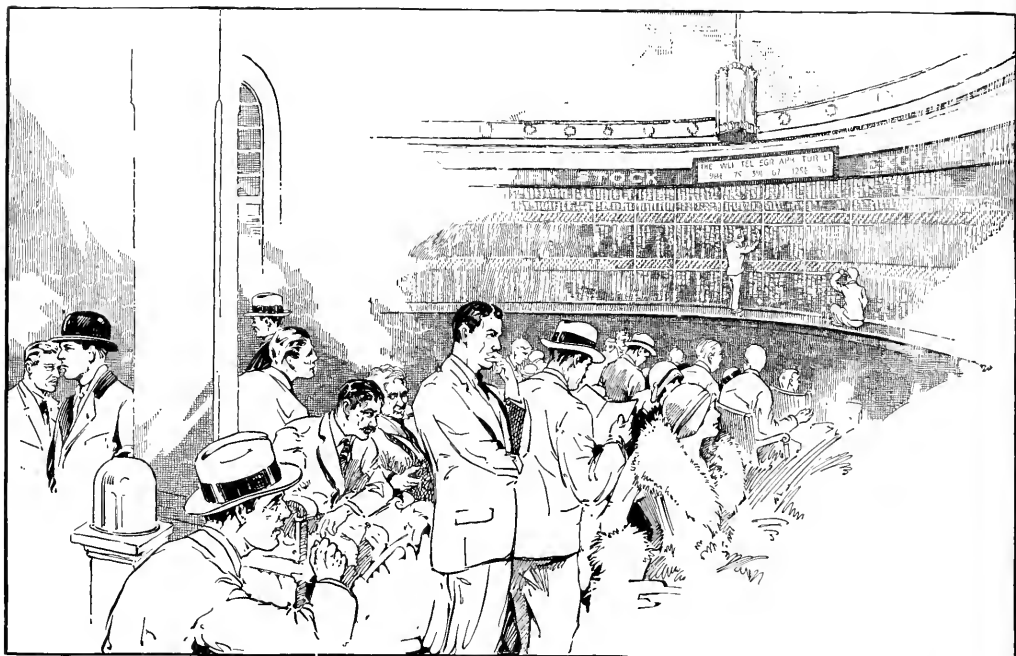
## THE CONSOLIDATED "PACIFIC SERVICE" SYSTEM REPRESENTS

- 16,000 employed in all departments.
- \$625,000,000 capital invested in gas, electricity, street railway, steam and water plants.
- 85,000 square miles of territory in which it operates—an area greater than that of England and Wales.
- 85,000 stockholders.
- 45 counties of the State in which it transacts business.
- 1,244,606 consumers served with gas, electricity, water and steam.
- 2,750,000 people in 45 counties, which is approximately 50 per cent of the State population.
- 609 cities and towns in which it supplies service directly and through other companies.
- \$29,800,000 annual wages paid employees, year ending December 31, 1930.
- \$9,000,000 taxes, Federal, State, county and local, year ending December 31, 1930.
- 1,082,632 horsepower developed in 48 electric water-power plants.
- 421,715 horsepower developed in 15 electric steam plants.
- 1,504,347 total horsepower developed in 63 plants.
- 3,288,241,000 kw. hours sold, year ending December 31, 1930. This is equivalent to the effort of 10,961,000 men.
- 23,016,940,300 cubic feet of gas sold, year ending December 31, 1930.
- 24 gas plants.
- 33,397 miles of transmission and distribution lines. Greater than the distance around the earth.
- 6,800 miles of mains used in distributing gas. Greater than the distance between San Francisco and Oslo, Norway.
- 955 miles of mains and ditches used in distributing power.
- 1,370 miles of track of railway supplied with electric power.
- 616,395,950,000 gallons of water storage capacity of 115 lakes and reservoirs. This amount of water would supply the City of San Francisco at the present rate of consumption for approximately 34 years.
- 216,561 acres of land owned in California.
- 571 parcels of property owned in cities and towns.
- 576,423 horsepower in agricultural motors depending on "Pacific Service."
- 1,304,937 horsepower in mining, electric railways, manufacturing and other motors depending on "Pacific Service."
- 19,923,300 incandescent lamps nightly lighted.
- 3,640,443 horsepower connected to system.

PACIFIC GAS AND ELECTRIC COMPANY

General Offices: 245 Market Street  
San Francisco

Branches in all principal cities and towns of 45 counties of North Central California.



## You Don't Need to Watch the Blackboard

*if you own Pacific Gas and Electric Company First Preferred Cumulative Stock.*

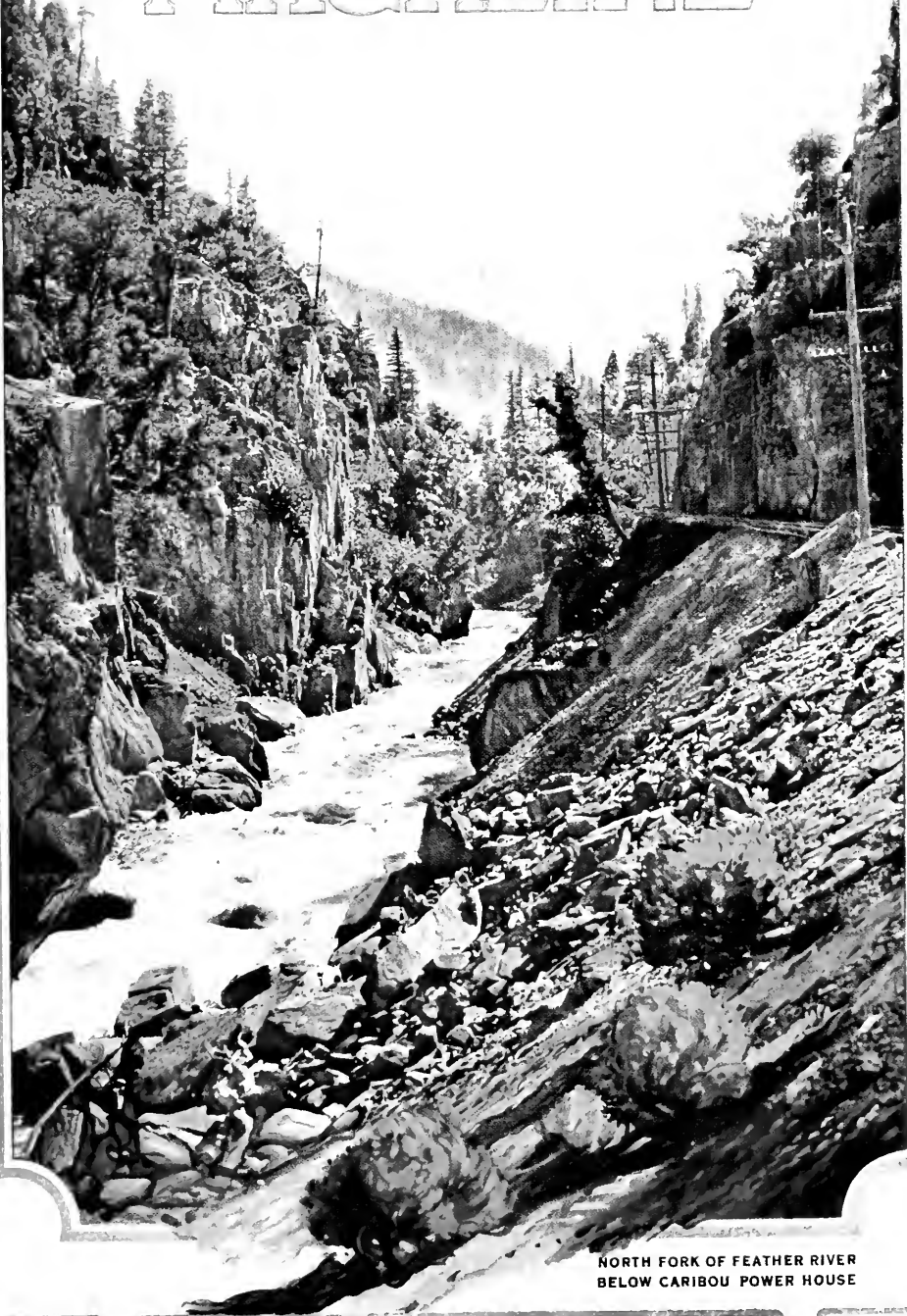
In good times and bad, in boom and depression, this Company's First Preferred Stock has never failed to pay dividends with the most punctilious regularity. The forty thousand holders of this high-grade security never need to entertain the slightest uneasiness as to the safety of their investment.

The Company is now offering a limited amount of its First Preferred  $5\frac{1}{2}\%$  Stock for sale direct to its customers and other residents of territory served.

Circulars descriptive of this investment issue will be mailed upon request.

**PACIFIC GAS AND ELECTRIC COMPANY**  
STOCK SALES DEPARTMENT • 245 MARKET STREET • SAN FRANCISCO

# PACIFIC SERVICE MAGAZINE



NORTH FORK OF FEATHER RIVER  
BELOW CARIBOU POWER HOUSE

Vol  
18

APRIL 1931

No  
4

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		Woodland
		San Francisco
		Stockton
		Jackson
		Sonora
		San Jose
		Redwood City
		Red Bluff
		Red Bluff

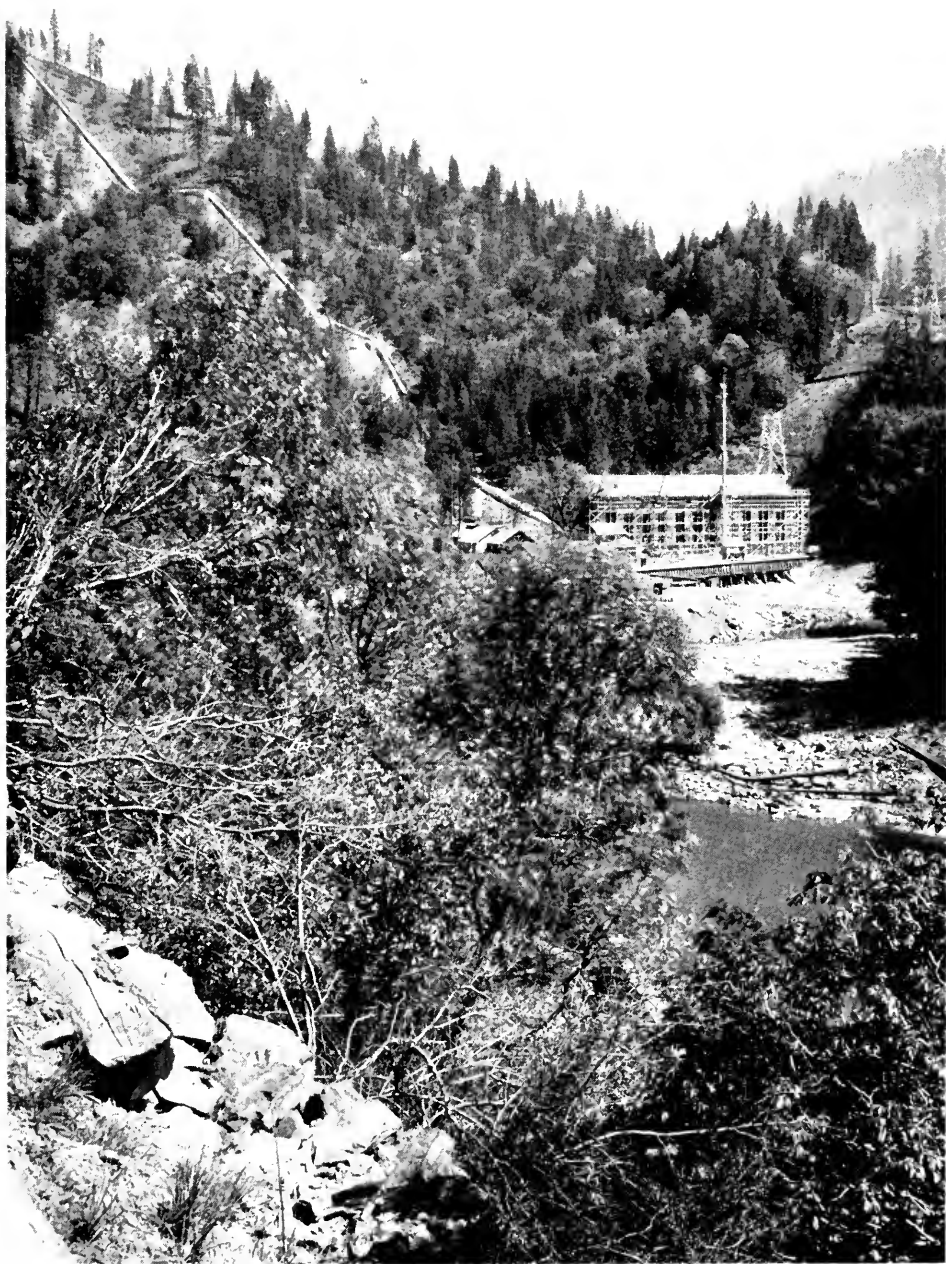
# Pacific Service Magazine

Volume XVIII                      APRIL, 1931                      Number 4

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Tiger Creek power-house, Mokelumne River development, nearing completion.

# PACIFIC SERVICE MAGAZINE

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## The "Pacific Service" Record for 1930

*Annual report shows satisfactory progress in the face of unusual conditions. Company's expenditures for new construction and betterments the largest in its history.*

The twenty-fifth annual report of the Pacific Gas and Electric Company, presented to the company's stockholders at the annual meeting held at headquarters in San Francisco April 14th, possessed features of unusual interest.

The company's activities during the past twelvemonth were prosecuted in the teeth of a general business depression of marked severity and duration. In addition, gross earnings were affected by a reduction of domestic and commercial electric rates throughout the "Pacific Service" territory and a general reduction of gas service cost through the substitution of natural for manufactured gas. Notwithstanding these drawbacks, the "Pacific Service" record for 1930 as disclosed at the stockholders' meeting was distinctly satisfactory.

The company's gross operating revenues from all sources in 1930 aggregated \$76,578,470, an increase of \$12,137,882 over the previous year's record. This total includes the results of operation of the Great Western Power Company, San Joaquin Light and Power Corporation and Midland Counties Public Service Corporation only from the date of their acquisition, June 12, 1930. This accounting procedure is, of course, technically correct, but a more informative view of the company's gross business and its trend is afforded by the combined gross operating revenues of all properties for the whole of 1930, which totaled \$85,577,193. This total is of value as indicating the aggregate earning capacity of the "Pacific Service" consolidated system for the year 1930.

Taking the first total of \$76,578,470: Of this \$56,427,269, or 73.69 per cent, was derived from the sale of electricity, \$18,418,919, or 24.5 per cent, from gas sales, and \$1,732,282, or 2.26 per cent, from minor activities, including revenues from the street railway department, water and irrigation departments and steam sales department. Electric sales revenues increased \$14,407,917; the greater part of this, however, was contributed by our newly acquired properties, reckoning, as before, from the date of their acquisition. Actually, the electric gross on the entire consolidated system increased \$1,776,243, or 2.8 per cent over the 1929 record, and kilowatt-hour sales of electricity increased 3.2 per cent. Effects of the current business depression were most severely felt in power sales, in addition to which the general reduction in electric rates throughout the territories of the Pacific Gas and Electric and Great Western Companies effective March 1, 1930, amounted to about \$3,000,000 annually; so that, all things considered, the showing made was far from unsatisfactory. Furthermore, it compared favorably with the record of the electric industry as a whole, the aggregate sales of electricity throughout the United States in 1930 having shown a decrease of 0.8 per cent.

On the gas side, gross revenues from the consolidated system showed a decrease of \$2,979,040. This decrease was anticipated by our company's management as a result of the introduction of natural gas, which having double the heating value of the manufactured product is naturally the more economical of use. However, an intensive business development campaign which has been in active progress since the previous year has already materially reduced the deficit in gas revenues and the company anticipates progressive recovery during 1931. The company estimates the cost saving to its gas con-

sumers at upwards of \$8,500,000 in the first full year of natural gas operation, but it is confident that any reductions of revenues will within a reasonable period be offset by increased usage, as natural gas has been received with acclaim by consumers all over the "Pacific Service" territory. Its value as an industrial fuel from the standpoints of efficiency and availability has already become so generally recognized that it bids fair to eventually replace all other fuels in this constantly increasing field of distribution.

The intensive business development campaign referred to was vigorously prosecuted throughout the year. Contracts estimated to yield an annual revenue of \$9,026,751 were secured in the territory served by the Pacific Gas and Electric Company and Great Western Power Company at a total sales cost of \$1,507,434, equivalent to \$5.99 of additional revenue for each dollar of sales expense. The new business actually signed exceeded by one-seventh the quota of anticipated business established at the beginning of the year, while sales expense, through the elimination of duplicate effort resulting from the consolidation of the two companies, was considerably less than the aggregate of their respective sales budgets. In the territory served by the San Joaquin Light and Power Corporation, new business was signed estimated to yield an annual revenue of \$1,861,532, the aggregate volume of new business contracted for on the entire system amounting to \$10,888,283 annually, a new record. The addition of this new business, insofar as it came on the lines in 1930, acted as an offset to diminished usage attributable to the business depression. It is expected, also, to be of continued benefit and to be reflected more completely in future earnings.

Other factors are expected to contribute materially to a general improvement in 1931. In the first place, the company's "operating ratio" is steadily on the decrease. Harking back to 1924, the record shows that in that year fifty-six cents out of every dollar of gross operating revenue was required for the payment of direct operating and administrative costs, for taxes and for reserves for uncollectible accounts and casualties; this operating ratio has fallen year by year until in 1930 it reached thirty-eight cents, the lowest in the company's history. Factors contributing to this showing were the increasing individual consumption and the more intensive loading of facilities resulting from sales efforts, continued modernization of equipment and methods, economies of consolidation and the smaller unit costs incident to larger scale operation. Second, the effect of our company's acquisition of its new properties has been to establish a unity of interest which will permit co-ordination of physical properties and administration, with resultant improved service of a standardized character, economies in operation, more efficient use of existing generating and transmission facilities, co-ordination of construction programs to meet future requirements and avoidance of the duplication of operating and administrative forces and of capital investment.

Against the company's gross operating revenues there was paid out in operating and administration expenses and taxes, exclusive of maintenance and reserves, the sum of \$29,050,926. State, Federal and other taxes, which are included in the foregoing, increased from \$6,813,406 in 1929 to \$8,295,522 in 1930, an addition of \$1,482,116. Taxes in 1930 absorbed 10.8 per cent of the gross operating revenues.

The sum of \$12,662,014, or 16.5 per cent of the gross operating revenues, was expended for maintenance or reserved for renewals and replacements. The annual provision for depreciation for many years has been computed from engineers' tables based upon the estimated lives of the various classes of property used in plant construction. The total upkeep provision for the past fifteen years has averaged over 16 per cent, or approximately one-sixth of all operating revenues received by the company. The accumulated balance in depreciation reserve at December 31, 1930, after writing off all property which has been abandoned through becoming worn-out or obsolete, was \$47,307,592. Net earnings from operation, after the deduction of all operating expenses, maintenance, taxes and reserves, except depreciation reserves, amounted to \$42,653,331, an increase of \$9,460,533. With the addition of \$790,918 of miscellaneous income, made up from interest on bank balances, income from investments and other non-operating revenues, a net income of \$43,442,249 was available for depreciation, bond interest and dividends on stock, including the divi-

dends on \$45,625,000 par value of common stock issued for the newly acquired properties, net earnings from which subsequent to their acquisition last June are included in the income account. Deducting from this net income \$12,265,269 paid out for bond interest and \$749,499 for bond discount and expenses, \$8,866,036 set aside for depreciation reserve, \$159,304 representing surplus earnings of subsidiary companies from June 1st to June 11th, 1930, prior to their acquisition, and \$6,537,127 dividends paid on preferred stock, there was left a balance of \$14,867,014 out of which to pay common stock dividends. This was equivalent to \$3.07 per share on the average of 4,845,584 shares of common stock outstanding for the full twelvemonth period. A sum of \$9,691,164 was paid out in common stock dividends, leaving an undistributed surplus balance of \$5,175,850, or \$467,821 more than in 1929.

This result, achieved as it was in the face of the unusual combination of circumstances previously referred to, speaks for itself.

At the close of 1930, 1,244,666 consumers were receiving "Pacific Service." Of these 729,080, or 58.6 per cent, were consumers of electricity, 505,208, or 40.6 per cent, were gas consumers, and 10,318, or 0.8 per cent, were taking water or steam service. Excluding 182,646 consumers taken over with the properties of the Great Western Power Company, San Joaquin Light and Power Corporation, Midland Counties Public Service Corporation and other smaller utilities, there was an actual net gain on all properties comprising the present consolidated system of 30,028 consumers.

The company's stockholders at the close of the year numbered 67,430, of whom 40,343 were holders of preferred stock and 27,087 holders of common stock. Stockholders resident in California numbered 54,498, or 80.8 per cent of the total. The company's stock registers included the names of 27,984 women and 25,984 men, 11,412 joint tenancies (usually husband and wife) and 2,050 insurance companies, banks, associations and other institutional investors.

Since the company's organization in October, 1905, the net additions and betterments to its properties as a result of construction work have aggregated \$276,598,006, and \$279,100,125 has been added through the acquisition of other utilities. Of the total of \$555,698,131 thus added to plant account in the past twenty-five years approximately \$520,000,000, or 83 per cent of the present book value of the company's total investment in fixed capital, represents properties constructed or acquired under authorization of the California State Railroad Commission since its assumption in 1912 of jurisdiction over the public utilities of the State.

Including \$45,228,231 advanced from working capital for construction and bond refunding, for which the treasury is entitled to reimbursement through the issuance of additional securities, assets at the close of the year equivalent to or susceptible of being put into liquid form aggregated \$77,998,042, or three and one-half times the \$22,590,997 of current and accrued liabilities. The company, as for the past fifteen years, closed the year with no floating debt.

Through acquisition of the Great Western Power Company, San Joaquin Light and Power Corporation and Midland Counties Public Service Corporation, with their subsidiaries, and other smaller properties taken over during the year, the aggregate assets of the company were increased from \$454,021,922 to \$684,687,466. Pacific Gas and Electric Company is now the second largest gas and electric operating company in the United States. It is second in size only to the Consolidated Gas Company of New York.

The company during 1930 demonstrated its unshaken confidence in the continued development of its field of operation by vigorously prosecuting its carefully worked out construction program without substantial modification because of the existing business depression. Gross expenditures for construction on the consolidated system was the largest in the company's history, aggregating \$49,513,946. This expenditure was largely financed by the sale of company securities.

On the electric side, the Mokelumne River hydro-electric development, which, upon completion, will represent an investment of approximately \$40,000,000, was carried forward during the year with maximum speed. At the year's close the big Salt Springs dam

was four-fifths completed. At the time of writing it is practically completed. Other construction features of the project were carried to near completion and it is expected that by the early summer of this year the development will be in operation. The Salt Springs and Tiger Creek power-houses, the first two of a series of four comprised in this undertaking will furnish a combined installed capacity of 95,000 horsepower. Twenty miles of concrete flumes and tunnels will convey the water from Salt Springs to Tiger Creek and the power generated in the two plants will be conveyed by 110 miles of 220,000-volt transmission line to the company's high-tension distributing station at Newark, in Alameda County. Newark substation is being enlarged at an approximate cost of \$2,000,000, to receive the additional power from this project. When this has been completed there will be nine high-tension lines ranging from 60,000 to 220,000 volts leading into this plant and twelve 60,000 to 110,000 volt lines leading out of it to various distribution centers. The incoming power lines will convey energy from hydro-electric plants having an installed capacity of 561,000 horsepower, constituting one of the largest power pools in existence.

Reconstruction and enlargement of Station "A," the company's chief steam-electric generating plant in San Francisco was carried forward without intermission during the year. More than \$6,000,000 has so far been expended on this work. The first unit, a steam turbo-generator of new design, operating under 1400 lbs. steam pressure with a rated capacity of 70,000 horsepower, but capable of delivering 85,000, was placed in operation in January, 1931. An eminent Eastern authority who visited Station "A" recently observed of the turbine that it was the last word in modern efficiency. A duplicate of this first unit is now in process of installation.

Other items of electric construction during the year include the enlargement of the Bear River, Towle and Wise canals on the company's South Yuba hydro-electric development; the completion of a 125-foot concrete dam at Lyons reservoir on the south fork of the Stanislaus River; extension of 110,000-volt lines in San Mateo and Monterey Counties; a general enlargement of substation, transmission and distribution facilities in various sections of the company's territory.

Use of natural gas as a fuel in steam-electric generating stations was extended. During the year 3,924,192,000 cubic feet of natural gas was consumed in the company's steam generating plants. This was equivalent to 713,000 barrels of oil, or more than four-fifths of the total fuel consumed at these plants for generating purposes.

Sales of electricity on the consolidated system during 1930 aggregated 3,286,619,411 kilowatt-hours, an increase of 3.16 per cent over the volume of sales on all constituent companies during the preceding year. The connected load of the 729,080 electric consumers at the close of the year aggregated 3,640,443 horsepower. The company operated 48 hydro-electric plants, with a total installed capacity of 1,082,632 horsepower, and 15 steam-electric generating stations, with an aggregate installed capacity of 421,715 horsepower. Electric service is now being furnished to 618 cities and towns, of which 578 are served directly and 40 indirectly, and to an extensive rural area. The well diversified character of the company's electric business is indicated by the fact that the average load throughout the year was 61.7 per cent of the maximum demand.

The most important event affecting the electric department during the year was the acquisition of the three California utilities previously referred to, which derive approximately 95 per cent of their revenues from the sale of electricity. Many operating economies were effected as the result of this merger, including the establishment of additional tie-lines making available larger standby service at strategic points and a shifting of load to the more efficient plants; the maximum utilization of available hydro-electric storage capacity and the consolidation of business offices at San Francisco, Oakland, Sacramento and other towns in which separate offices have previously been maintained. The saving from operating economies is estimated at between \$1,250,000 and \$1,500,000 per annum exclusive of economies in connection with financing.

On the gas side, natural gas is extended to practically all of the major communities in the company's territory, among them being fifty-one which have previously been without gas service of any kind. At the present time 97 per cent of the company's gas consumers

are now receiving natural gas. During the year, 520 miles of transmission mains, ranging from 6 to 26 inches in diameter, were constructed. The largest single item was the completion of the Standard-Pacific line from Kettleman Hills field in Kings County to the San Francisco bay region. The construction of this line in the joint interests of the Standard Oil Company and Pacific Gas and Electric Company gave our company a second source of gas supply for the San Francisco bay area and also enabled it to reach other sections of the "Pacific Service" territory which could not have been supplied from the original line. The line has a present daily capacity of 120,000,000 cubic feet of gas. A 22-inch pipe line 36 miles in length was constructed from Tracy to Milpitas for the purpose of connecting the new transmission line with the first which was completed in 1929. This interconnection gives added assurance of continuity of service throughout the territory.

In the interest of conserving the gas resources of the Kettleman Hills region, gas wells in the Buttonwillow field, the company's supplementary source of gas supply in Kern County, were shut down in October, this gas being held in the ground as a reserve supply for future use. As an incident to the operation of the natural gas system 72 buildings were designed and constructed for the Kettleman Hills compressor plant and for patrol sites on the natural gas transmission line. At the patrol sites thirteen wells were drilled, ranging in depth from 113 to 1,018 feet, to secure the necessary water for operation purposes.

The quantity of natural gas transported through the two trunk lines increased from a daily average of 50,700,000 cubic feet in December, 1929, to 108,800,000 cubic feet in December, 1930, with a maximum of 141,822,000 cubic feet on December 30th.

Gas sales for the year aggregated 23,017,229,700 cubic feet. While this total showed a volumetric decrease of 268,620,800 cubic feet, or 1.5 per cent, from the 1929 record, based on equivalent heat units the sales far exceeded those of any previous year in the company's history.

A ten million cubic foot holder in San Francisco and one of eight million cubic feet in Oakland, construction of which was begun in 1929, were completed in 1930. The holders, of waterseal telescopic design, furnish additional natural gas storage and assurance against service interruptions in the San Francisco bay region.

An average of 16,385 men and women were employed on the consolidated system throughout 1930, or 2,341 more than in the preceding year. Payrolls aggregated \$29,773,024, of which \$15,586,107 was paid to operating employees, and \$14,186,916 to those engaged in construction work. At the close of the year there were 15,771 employees in the service of the company and its subsidiaries, of whom 5,391 held service badges in order of recognition of five or more years of continuous employment.

As of December 31st, 122 retired employees of the company were receiving pensions under a system placed in effect in 1916. Pension payments in 1930 aggregated \$78,823.

The Pacific Service Employees' Association, which is purely voluntary and includes substantially all permanent employees of every rank, had a membership of 9,200 at the close of the year. The activities of this association embrace educational and social work among employees, payment of death benefits and the rendering of temporary financial assistance in case of need. An increasing number of employees availed themselves of the educational courses conducted by the association, 502 certificates being awarded to students completing educational courses in 1930. Altogether, 2,934 certificates have been awarded since the inauguration of these activities. An employees' disability plan, with a present membership of 6,794, is conducted by the association. The amount paid in benefits during 1930 aggregated \$50,955.90.

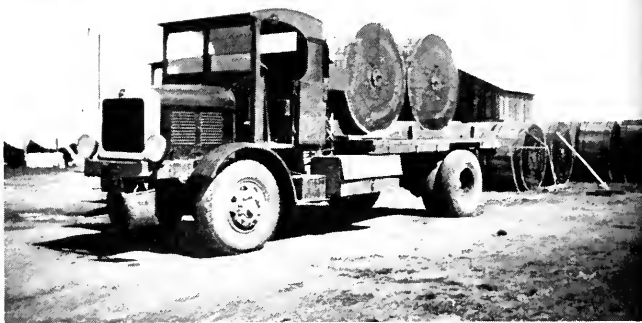
President A. F. Hockenbeamer presided at the annual meeting of stockholders. Reports of progress were presented by the President and Mr. P. M. Downing, First Vice-President and General Manager. At the close of the meeting a resolution was adopted confirming the acts of the administration during the past year. The existing Board of Directors was re-elected.

# Constructing Transmission Lines on Our Mokelumne River Project

By WM. T. HANNUM, Assistant to Engineer of Line Construction

In order that power which will be generated at the new Salt Springs and Tiger Creek power-houses on our company's Mokelumne River project, now nearing completion, may be available to consumers of "Pacific Service" in all parts of Northern California, transmission lines are being constructed from these power-houses to Newark Substation, the company's large distributing center on the south end of San Francisco Bay. A tap will also be made from these lines east of Stockton, to carry a portion of this power to the San Joaquin Light and Power Company's territory toward the south.

A single line of snow-type towers with three 4/0 copper conductors, insulated for 110,000 volts, will carry the power from Salt



A 5-ton load of copper wire.

Springs to Tiger Creek, a distance of 17 miles, through the virgin pine and fir forests covering the mountainous country which forms the northern slope of the Mokelumne River canyon. Snow falls in this country every winter, often to a depth of several feet on the highest ridge, which is over 4000 feet in elevation.

From Tiger Creek the power from both power-houses will be transmitted 109 miles to Newark over two 220,000-volt circuits. Two parallel lines of snow-type towers support the six 518,000 C.M. steel-cored aluminum conductors, 1 inch in diameter and weighing 1.12 lbs. per foot, for approximately 16 miles to the small town of Mokelumne Hill.



One million, three hundred thousand pounds of copper wire stored in camp at Bellota.

From this point to Newark all six conductors are on a single line of double-circuit towers. The aluminum conductors are replaced at Valley Springs by 500,000 C.M. hollow I-beam core copper cable, 1 inch in diameter and weighing 1.62 lbs. per foot.

The country between Tiger Creek and Mokelumne Hill is mountainous but fairly accessible by county and private roads. Dense thickets of second growth pine prevail to the crossing over the Mokelumne River near the old Electra powerhouse. Here the forest changes to scrub oak with scattered pines and becomes thinner in the foothill country toward the south and west, ceasing entirely at the Calaveras River crossing east of Bellota. The 220 k.v. line from Tiger Creek thus traverses 16 miles of mountainous country to Mokelumne Hill, 27 miles of foothills to Peters, 36 miles of the flat, cultivated San Joaquin Valley past Stockton and Tracy to Midway, 27 miles of the steep, grass-covered hills of the Coast Range past Livermore to Irvington, and 3 miles of level land bordering the bay to Newark Substation.

A program for the construction of these lines was drawn up so that they would be completed in June, 1931, when it was estimated that the new power-houses would be ready to deliver power. In carrying out this program, the co-operation of the Land Department was necessary so that the surveying



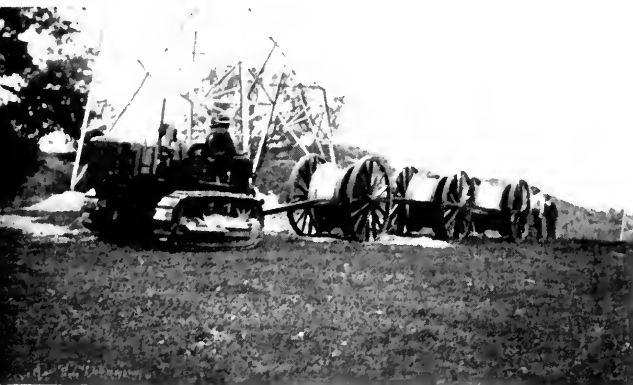
Tractor and trailer on the job.

and the purchase of the rights of way were prosecuted sufficiently in advance to insure uninterrupted progress. The delivery of materials was also scheduled, and this in turn depended on the co-operation of the Engineering Department in completing the designs and specifications.

Very little construction equipment was available for the work because other activities had to be carried on as usual. Selection of new equipment was made with the idea in view that it must be adaptable to ordinary work or that it must pay for its cost on this project.

Motor trucks naturally formed the major item of equipment. For heavy work 18 trucks with dual pneumatic rear tires were used. These were rated at  $3\frac{1}{2}$  tons capacity, but were easily capable of carrying a 5-ton load. Four were of the four-wheel-drive type. Six were equipped with power-operated dump bodies of 3 cu. yds. capacity and most of the others with power winches. These trucks were chiefly used for hauling material and heavy equipment. Five  $2\frac{1}{2}$ -ton trucks, also with dual pneumatic rear tires and with power winches, served for hauling men and equipment and to furnish power for hoisting. For light work, such as hauling men with hand tools,  $1\frac{1}{2}$ -ton Fords proved quite satisfactory.

In the past, horses with wagons and sleds had al-

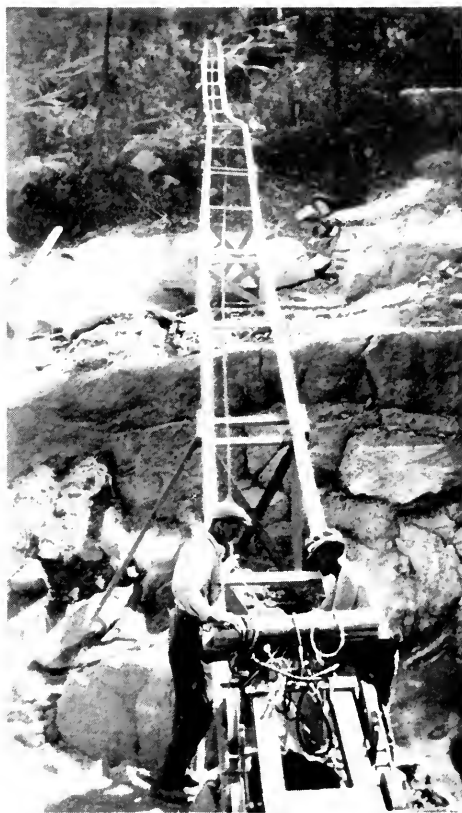


Laying out copper wire for transmission line.

ways been employed to deliver material and to furnish power at locations in the mountains inaccessible to trucks. On account of the difficulty of synchronizing teams with motor trucks, the necessity for extra camps, and the transportation of their feed, it was decided that tractors would be more economical. Four were used, all of the track-laying type, rated at 30 h.p. and equipped with power winches. Three track-laying trailers were used with the tractors for transporting material, two of which had hand-operated dump bodies of  $1\frac{1}{2}$  cu. yds. capacity.

Other equipment which was secured will be described in connection with the particular work for which it was used.

Camp locations and shipping destinations were studied with care. Where possible, selection was made to keep the maximum distance for hauling men and material at about 10 miles. From Martell, however, the terminus of the Amador Central Railroad, it was necessary to haul material by truck over 40 miles to the Salt Springs end of the line, about half of this distance over the company's private road. Three camps established by the General Construction Department were utilized for work on the upper end of the line, and ten camps were installed for use on the balance of the line. Storage yards or warehouses were leased where available at the nine railroad shipping points. A standard camp consisted of a 24 by 40 ft. combination kitchen and dining tent, seating 60 men, and 16 by 18 ft. sleeping tents, accommodating 5 men each. The camps were expanded as desired by increasing the number of tents. The number of men actually accommodated in a camp at one time varied from 15 to 150 men. At the peak of con-



Timber tramway, to transport material to tower sites.

struction activity seven camps were in operation, with 365 men on the payroll.

The first item of construction work to be undertaken was clearing the timber from the right-of-way in the mountain and foothill sections of the line. This was started in October, 1929, in order to burn the brush during the wet months when the fire hazard was at a minimum, and in order to be prepared to start other work in the spring of 1930. A strip of land 100 feet wide was cleared for the single line of towers from Salt Springs to Tiger Creek, chiefly on U. S. National Forest lands, and 175 feet wide for the double line of towers to Mokelumne Hill.



Concreting foundations for steel tower.

Only 70 feet was cleared for the double-circuit towers through the smaller timber in the foothills. Altogether, 52 miles of line was cleared, involving an area of 466 acres, 66 acres of which was done by the property owners under contracts. A crew of about 60 men worked through the winter, part of the time in snow up to two feet in depth, and nearly double this number were employed in the early spring months. All timber felling and brush burning were completed by June, 1930, but cutting the timber into log and cordwood lengths, to comply with right-of-way agreements with the property owners, continued with a smaller crew until September.

Tractors with their power winches were used to remove logs from the line, and in some places it proved more economical to use them to pull bushes and small trees out of



Making up dead end of Tiger Creek-Newark line.

the ground than to cut them off by hand.

In the mountains, many temporary roads were built to reach the tower locations from existing roads, which frequently had to be repaired, and many abandoned roads were reopened. The roads were constructed for trucks where gradual curves with grades under 20 per cent could be obtained with a reasonable amount of work. If these conditions were not to be found or where no turning room was available at the end, the roads were left narrower for use only by tractors with trailers or sleds. On account of the prevalence of solid granite ledges and huge boulders, even roads for trailers could not be constructed without exorbitant cost to eleven tower locations on the Salt Springs end of the line. To deliver material to these places which were above the company's private road and from one to six hundred feet distant, inclined timber tramways were constructed. A portable gasoline engine hoist supplied power to a cable to raise and lower a small tramcar. This equipment was moved from one tramway to another as needed. Foot trails were constructed across the steep canyons for use by the construction crews in walking from tower to tower and for permanent use in patrolling the line.

Ten  $3\frac{1}{2}$ -ton trucks were operated as a fleet for the delivery of the heaviest materials, including gravel and reinforcing iron for the concrete foundations and galvanized steel for the towers. The gravel was handled by six trucks with dump bodies, hauling 3 cu. yds. per load. The amount required per tower varied from 6 to 22 cu. yds. for the standard towers, with 150 cu. yds. needed for special river-crossing towers. Between Salt Springs and Tiger Creek crushed rock and sand were



Tying-in conductor on steel tower.

obtained from crushing plants installed by the General Construction Department for its needs. Mixed rock and sand or washed gravel was purchased for the balance of the line. This material was unloaded from railroad cars into stock piles at the rate of nearly a car per hour by a portable crane with a clamshell bucket. The trucks were loaded in about 5 minutes each by a portable bucket elevator, operated by one man. Nearly 13,000 cu. yds. of gravel was hauled by these trucks. The tower steel, totaling more than 5,000 tons, for the 992 towers in the line, was all fabricated in California. The standard towers varied in weight from 2 to 7 tons, and the special river-crossing towers weighed as much as 30 tons. This material was all segregated in yards at the railroad destinations and then hauled out by truck, except 250 tons for nine special towers which was transported from San Francisco by barge to the river crossings south of Stockton.

Excavation for the tower foundations was started at the beginning of April, 1930, after the road and trail work was a distance ahead. For the snow-type towers in the mountains the holes (four to each tower) varied from 3 ft. 6 in. by 4 ft. 6 in. and 6 ft. deep to 6 ft. 6 in. square by 8 ft. deep, requiring the re-



Transposition tower, near Bear River, below Salt Springs.



Typical dead-end, single-circuit steel towers.

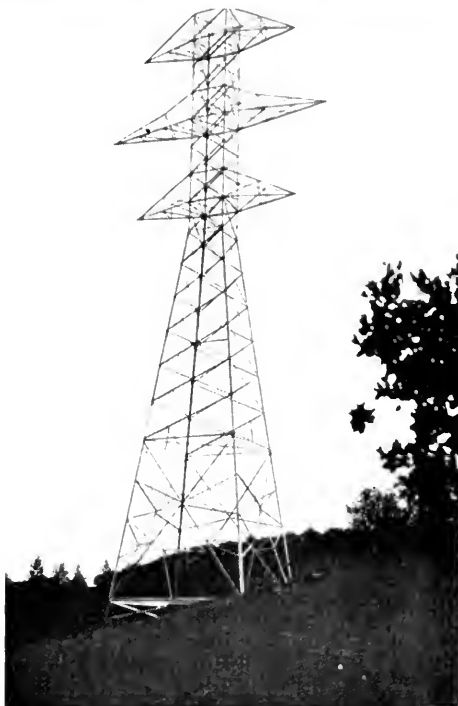
moval of from 12 to 44 cu. yds. of earth per tower. Two portable air-compressors with jack hammers were used to drill holes for blasting where hard rock was encountered, chiefly between Salt Springs and Tiger Creek, but also at occasional places lower in the mountains and even in the foothills near Valley Springs. Most of the foundations near Salt Springs were excavated in solid granite ledges, and at several locations large boulders had to be blasted away before the excavation proper could be started. In decomposed rock and hard-pan soils, the work did not warrant moving and setting up the compressors, so hand drills and sledge hammers were used to make holes for blasting. The standard double-circuit towers required an excavation of 20 cu. yds. each, with holes 4 ft. 2 in. square by 7 ft. deep. Where conditions were suitable, as in the San Joaquin Valley, earth-boring machines dug holes 3 ft. in diameter and 8 ft. 5 in. deep. One machine with six men excavated the 9 cu. yds. of earth for a tower foundation in from 30 to 90 minutes, depending upon the type of soil. Over 20,000 cu. yds. of earth was excavated for all the foundations in the line.

Two transitmen with a small crew of help-

ers installed the anchors for the towers and the reinforcing bars for the concrete. The steel angles forming the anchors were set to within  $\frac{1}{8}$  inch of correct horizontal and vertical dimensions, and held in place by a pipe templet supported on adjustable wood stands.

Approximately 10,700 cu. yds. of concrete was poured for the tower foundations. This concrete was mixed at the tower locations with  $3\frac{1}{2}$  cu. ft. capacity portable mixers. Water was delivered by a standard utility truck carrying two 500-gal. tanks. Each of the mixing crews also had as a part of their equipment a tank mounted on a trailer, which was filled at each location. Four crews of ten men each completed from four to ten tower foundations a day, depending on the size of the foundations, the difficulty of moving and other conditions. The sheet-steel forms used for the concrete and the templets were usually removed and the holes back-filled  $1\frac{1}{2}$  or 2 days after the concrete was placed. Good weather prevailed for all except the last 30 days of foundation work, which was completed at the end of January, 1931.

The tower-building crew was organized after the foundation work was well under way in the middle of June, 1930. An advance crew arranged the steel on the ground in a manner convenient for erection and



Typical twin-circuit 220 k. v. tower,  
Mokelumne River project.



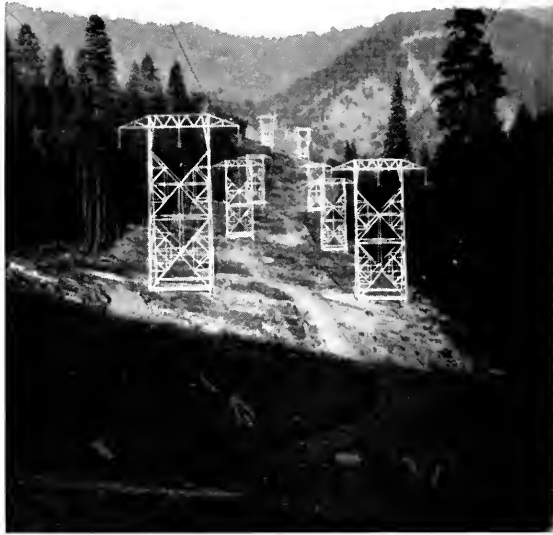
220,000-volt tower lines on Mokelumne River project. View taken from  
Doak's Ridge, just above Tiger Creek power house.

assembled certain minor portions which could be raised as units. The erection crews, consisting of six men each, built up the towers piece by piece with the aid of gin poles and block and tackle. Trucks were used to furnish power for hoisting heavy members or assemblies, especially crossarms on the double-circuit towers. The standard snow towers are 57 feet high and the double-circuit towers 98 feet. From 50 to 70 men were engaged in the erection of these towers. Separate crews of twelve men each were organized for building the special river-crossing towers. Portable gasoline-engine hoists raised all members on these towers, which varied from 134 feet to 219 feet in height, with individual members over 40 feet in length and weighing nearly a ton. With the material all delivered during the summer and fall, it was not difficult to continue the erection of towers during the winter months.

The last item in the construction of the transmission lines, namely, stringing the conductors, was started early in September of last year. Nearly a month was required to install the three 4/0 copper conductors for the 110 k.v. circuit between Salt Springs and Tiger Creek, on account of the extremely rough country and the numerous crossings over an existing 17 k.v. pole line which furnished power for the other construction activities in this vicinity and which could only be taken out of service on Sundays. Tractors proved their worth in this phase of the work, as they had in all others at which they had been tried, both in laying out the conductors along the line and in pulling to the proper tension.

The steel core aluminum conductors for the upper end of the 220 k.v. line were received in 4900-foot lengths on large reels 6 feet in diameter, weighing nearly 3 tons each. The lengths of wire were spliced together with two sleeves, a steel one for the stranded steel core and an aluminum one for the outer aluminum strands. Both were installed with a portable hydraulic press capable of exerting a pressure of 100 tons.

No wire was strung during the winter months after the middle of December until the middle of March, when work was started



Looking East along 220 k. v. tower line, Tiger Creek Canyon and Doak's Ridge in background.

stringing the hollow core I-beam copper conductors from Valley Springs to Newark. This wire was received in half-mile lengths on reels just a little smaller and lighter in weight than reels of aluminum wire. The lengths of copper conductors were spliced together with a threaded sleeve which screwed on right and left hand threaded lugs, installed on the ends of the wire at the factory. If extra splices are needed in the conductors a hollow splicing sleeve will be drawn on the ends of the wires by means of a portable draw-bench. The copper wires are pulled to a tension of nearly 6,000 lbs. each.

The standard insulator strings by which the conductors are suspended from the tower crossarms are 6 ft. 8 in. long and consist of 13 suspension insulators and a corona shield. The dead-end strings consist of the same number of higher strength insulators and are 8 ft. 7 in. long. In portions of the line where the weather is frequently foggy longer strings of insulators are used, the maximum being 20 units in suspension strings 9 ft. 10 in. long and the same number in dead-end strings 12 ft. 8 in. long.

## Conservation of Natural Gas in Kettleman Hills Oil Field

By FRED F. DOYLE, Manager Natural Gas Division

The combined efforts of the State of California, through its Division of Oil and Gas, and the oil-producing companies of the State to conserve natural gas have been aided by the co-operation of the Pacific Gas and Electric Company in the speedy construction of its huge pipeline system by which natural gas is transmitted and distributed to the cities and towns of Northern California.

The company commenced the construction of this transmission system in January, 1929, completing its first line extending from Kettleman Hills to San Jose, San Francisco and Oakland in August of that year. Following the completion of that line the company entered an agreement with the Standard Oil Company of California to jointly construct a second line extending north from the Kettleman Hills along the west side of the San Joaquin Valley to Tracy, Pittsburg and San Pablo. In addition, the company constructed its own branch line to Stockton and Sacramento, a line from Tracy to Milpitas connecting to the original line and a line across the Carquinez bridge to Vallejo and through

the territory north to Santa Rosa, Petaluma and Healdsburg, with a branch to San Rafael and Sausalito.

By means of these facilities the company has been able to serve ninety-seven per cent of its customers with natural gas. There is being transported for its own account an average of 113 million cubic feet of gas per day, the maximum amount for any one day to date being 145 million cubic feet on January 7, 1931. The bringing of this fuel to Northern California by the Pacific Gas and Electric Company has not only been a means of supplying over 500,000 consumers with a clean, labor-saving fuel for heating homes and for cooking but has brought to industrial consumers a more convenient and economical fuel of high heating value.

The large amounts of gas available in the oil fields gave rise to the speculation as to how it would be utilized and not wasted. This question has been well settled by the co-operation of the majority of the oil and gas companies with the State Government and by the piping of this valuable product to the



Bird's-eye view of the Pacific Gas and Electric compressor station and field headquarters at Kettleman Hills.



Close-up view of our company's compressor station at Kettleman Hills.

centers of population of Northern California.

Two and one-half years ago a range of hills came into prominence in California in relation to the oil and gas industry. They are the famous Kettleman Hills, the location of one of the largest potential supplies of high gravity crude oil and natural gas in this country, if not in the world. These hills are located in Fresno and Kings Counties on the west side of the southern part of the San Joaquin Valley, about sixty miles south and west of the city of Fresno. They extend from northwest to southeast a distance of thirty miles and have a width of from five to six miles. Due to the arid climate of this region the vegetation consists only of scattered sagebrush and short grass. The hills, therefore, stand out prominently from the broad San

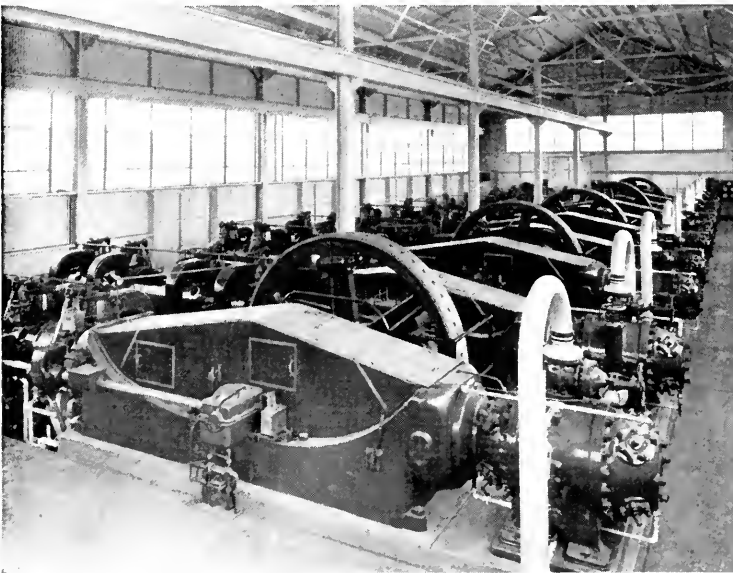
Joaquin Valley to the north and east and to the Kettleman plains on the southwest.

The tops of the hills are approximately seven hundred feet above the Kettleman plains, eleven hundred feet above the San Joaquin Valley, and fourteen hundred feet above sea level. They are divided into three sections, known to the oil and gas industry as the North, Middle, and South Domes, which are roughly fourteen, nine and seven miles in length, respectively.

It had been thought for many years that crude petroleum deposits existed beneath these hills. The first wells for prospecting for oil and gas were drilled twenty-four years ago, but at that time the prospectors were not successful in securing oil, due mainly to the shallow depths of the wells, which ranged from 670 to 1100 feet. Seven of these wells

were within an average distance of two and one-half miles from the discovery well which will be mentioned later.

In 1910 a well was drilled which was at that time considered a deep test, a depth of 4100 feet being reached. Since that time, thanks to the activities of American engineers, geologists and inventors in the oil industry, drilling tools and equipment, casing, derricks and methods of drilling have been so



Interior of compressor building, Kettleman Hills station.

greatly improved that depths almost twice that of the 1910 well have been reached. The untiring efforts of oil prospectors and oil companies were rewarded when the oil and gas-producing sand was encountered in the Kettleman Hills. It has been estimated that a total of twenty-five miles of prospect holes had been drilled before the producing horizon was located.



Kettleman Hills water wells and pumping station, nine miles southeast of compressor station.

The Milham Exploration Company, a subsidiary of the Mexican Seaboard Oil Company, brought in the first producing oil and gas well, known as the discovery well, on October 5, 1928. It is called the "Elliott Number One" well and is located in the southwest corner of section 2, township 22 south, range 17 east, M. D. B. & M., in Kings County, California. Drilling operations had been carried on for seventeen months before production was obtained from the well.

The discovery well was drilled to a depth of 7,236 feet. Due to drilling troubles at that

depth caused by the separating of the drill pipe the bottom of the hole was cemented off. When operations were resumed the well "blew in" unexpectedly from a depth of 7,108 feet, shooting large volumes of very light oil and natural gas high above the derrick.

After much effort the well was placed under control on October 25, 1928, although it was not possible to completely shut it in. It was necessary to leave five thousand feet of drill pipe in the well which acted as a restriction to the flow of oil and gas, but notwithstanding this condition its initial production was four thousand two hundred barrels of high grade oil, containing eighty-nine per cent gasoline and an estimated natural gas production of eighty-five million cubic feet daily.

The securing of such a large production of valuable oil and gas naturally induced the other oil companies owning land or holding oil and gas leases in that area to commence drilling operations on

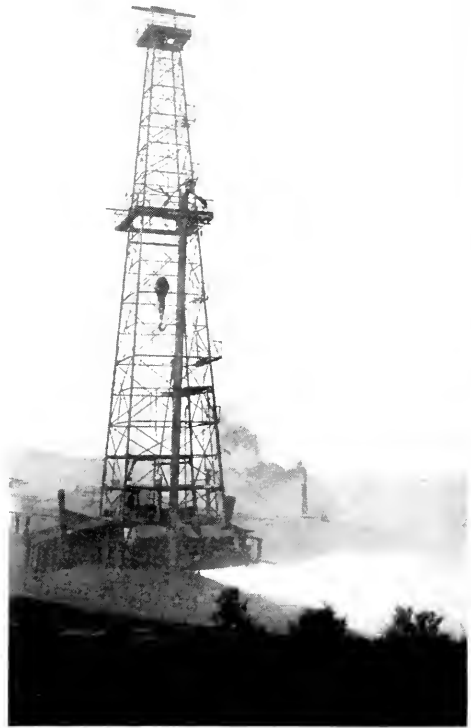


Discovery well—Elliott No. 1—Kettleman Hills.

their lands. Previous to the discovery of oil and gas in the Kettleman Hills the Pacific Gas and Electric Company had plans under way to transport natural gas to San Francisco and the bay region and had contracts already signed for the purchase of gas in the Buttonwillow area, in the vicinity of Bakersfield. The company, however, watched with great interest the prospecting work in the Kettleman area and realized the great possibilities for a future supply of gas from that area. Other contracts were made shortly after the discovery well was completed in the Kettleman Hills, thus securing for the company an additional and greater source of supply of gas for its requirements.

At the end of the year 1929 two other wells had been successfully completed, giving an additional production of ten thousand five hundred barrels of oil and approximately two hundred million cubic feet of natural gas daily. During the year 1930 four other wells were completed with a production of over eleven thousand barrels of oil and two hundred and thirty-six million cubic feet of natural gas. A fifth well was finished with an estimated potential production of forty-two hundred barrels of oil and eighty-five million cubic feet of gas daily; but this was shut in, a production test only being made.

Previous to and at the time of the discovery of the Kettleman Hills field there was an over-production of crude oil and natural gas in the other fields of California and efforts were being made to curtail drilling operations and reduce the production of oil and



Bringing in of Discovery well.

gas. A great many of the large operators in the State were working in conjunction with

the State Mining Bureau to reduce materially the production, so that the bringing in of such large wells made the problem more acute and greater than before. In fact, it was seen that too rapid development of the new field would have a very detrimental effect on the oil industry as a whole and result in the waste of enormous quanti-



Standard Oil absorption plant. Discovery well at left.

ties of gas, a valuable natural resource which would eventually be gone forever.

While curtailment was being made in the other fields steps were taken early in 1929 to establish co-operation between the operators at Kettleman so that the field would be developed at such a rate as not to be a menace to the industry. Accordingly, an agree-

ment was made between the large companies controlling practically all of the North Dome area whereby the completion and bringing in of other wells would be delayed two years, during which time it was projected to develop a unit plan of operating the field.

The Standard Oil Company of California is the owner in fee of over one-half of the North Dome area, and a great portion of the balance is held under United States Government prospecting permits. Under these permits the holders were required to show oil production in order to claim a discovery and retain their permits. In order to aid in the conservation move the United States Department of the Interior agreed that proof of claim could be established by merely drilling into the oil sand, securing a sample of it by coring or making a production test but not producing any oil. Several wells were drilled by the companies in this manner and are standing idle today, thereby holding down the field's production and preventing further waste of natural gas.

Two of the smaller companies failed to enter the two-year pact, however, and proceeded to drill wells and produce them. This of course led to further waste of natural gas in large quantities. They leased their lands from individuals who owned the lands in fee and who would not consent to suspend drilling operations. In order to protect their own holdings, companies whose properties adjoined those lands were forced to drill offset wells and thereby further increase the production.



Northern end of North Dome, Kettleman Hills.

The State of California, through its Division of Oil and Gas, a few years ago became greatly interested in the conservation of natural gas as a result of the enormous quantities being lost in the various parts of the commonwealth. The result was the passage of the Natural Gas Conservation Law by the winter session of the California State Legislature in 1929, the bill being signed by Governor Young in May, 1929. Its enforcement was opposed by some of the smaller companies operating in the southern fields of the State, but it was held to be constitutional by the Supreme Court.

Due to the efforts of the majority of the producers in the Kettleman Hills to work out their own conservation plan it has not been found necessary to enforce this law in the entire field. However, a court injunction has recently been issued restraining operators from producing oil with an unreasonable waste of gas in violation of the conservation law.

The amount of gas that can be produced is limited by what is known as a "gas-oil ratio," or a certain quantity of gas per barrel of oil produced. The gas is located in sands together with the oil and forces the latter to the surface, being produced with it. By proper drilling, casing and operation of the wells the gas-oil ratio can be held down. This ratio at the present time varies from 1000 to 40,000 cubic feet of gas per barrel of oil in the Kettleman Field. The proper amount of gas to be produced to give the greatest efficiency is best determined experimentally by petroleum

engineers of the various companies interested in the field. The limiting of the gas-oil ratio not only tends to conserve gas but results in a greater ultimate production of oil from a field, as too great a production of gas is an unnecessary loss of natural power which can be utilized to bring the oil to the surface.

After almost a year's work a committee consisting of representatives of operators holding lands in the North Dome of the Kettleman Hills completed a unit plan for the economical development of that area. Under this scheme the field will be operated by two units, the Kettleman North Dome Association and the Standard Oil Company of California.

The association is incorporated under the laws of the State of California and will operate all productive lands on the North Dome with the exception of fee lands owned by the Standard Oil Company and a few small parcels of land operated by those who did not go into the association. The Standard Oil Company will operate its own fee lands, which comprise approximately 45 per cent of the area, under an operating agreement with the Kettleman North Dome Association.

What is known as the area of original production, under the unit plan, amounts to 10,800 acres. This area may be changed yearly during the first ten years of the agreement upon resolution adopted by a two-thirds vote of all the directors, but will not be changed after the ten-year period. Future production will determine what changes in the outer boundary will be made. Ninety-two per cent of the area affected will be operated under the unit plan and the agreement provides for the balance of the operators entering the association if such an arrangement can be worked out.

Persons or corporations with rights to develop lands for oil and gas in the North Dome are eligible for membership in the association. Members will be required to furnish money for capital and operating expenses and will share in the production of oil, gas and gasoline in the ratio that their proved acreage plus a varying percentage of their non-productive acreage bears to the total proven acreage plus the total non-productive acreage for the first ten years of operation. From that time on their participation will be based on the ratio of their holdings in the defined productive area to the total acreage in that area under control of the association.

The North Dome Association started active operations on April 1, 1931, and will conduct its activities in such a manner so as to obtain the maximum yield of petroleum products from the association's properties without the wasting of natural gas as prohibited by the State Gas Conservation Law and the laws of the United States.

At present the program calls for the shutting-in or "killing" of two of the original wells where the gas-oil ratio is abnormally high. The oil production lost from these wells will be offset by production of wells already drilled into the oil sand and standing idle, or from new wells being or to be drilled which will produce with a low gas-oil ratio.

This plan will be very beneficial to the gas utilities as it will greatly prolong the life of the field and conserve for their requirements billions of cubic feet of natural gas which would otherwise be wasted and lost forever.

The oil producers will also profit greatly by this operation of the association, as not only will the ultimate recovery be far greater but it will tend to reduce the great over-production of oil which exists.

The present trend in the United States is to operate oil fields under a unit plan, which is beneficial in the end to all operators and individuals. The Public Lands Committee of the United States Senate has approved a bill authorizing the unit plan of operation of the Kettleman Hills and its extension to other parts of the public domain.

During the year of 1930 there was produced in California 617 billion cubic feet of natural gas. Of this total 141 billion cubic feet was purchased mainly by public utilities, 221 billion lost, and 15 billion stored, the balance being used in the fields.

During the past year the conservation movement was greatly helped by the closing-in of the dry gas wells in the Buttonwillow field and substituting the gas that was being taken from that area with gas from the Kettleman Hills field which otherwise would have been wasted. This was accomplished by the combined efforts of the Milham Exploration Company, the Pacific Gas and Electric Company and the land owners, resulting in the saving for future use of half a billion cubic feet of gas each month.

By continued efforts to conserve the natural gas in the Kettleman Hills to which our company is giving its co-operation, the life of the field will be prolonged and a supply of this efficient fuel assured for many years.

# Beginnings of the Great Western System—Story of Lake Almanor

By W. H. SPAULDING, Attorney, Law Department

Erstwhile Great Westerners are proud to have brought with them into the Pacific Gas and Electric fold Lake Almanor, the great power reservoir at Big Meadows, in Plumas County. Its great beauty and immense expanse captivate the imagination. Resting at four thousand five hundred feet above sea level amidst the pine forests, it is the largest power reservoir in the United States, perhaps in the world. Its storage capacity is rated at 1,300,000 acre-feet.

Julius M. Howells, a well-known hydraulic engineer, first cousin of William Dean Howells, visited that region in the latter part of the last century and had the vision of transforming the immense mountain meadow into a vast lake for hydro-electric development. At that early date, an electric enterprise was regarded in conservative investment circles as the rankest of speculations. In the late summer of 1901 Mr. Howells laid his scheme before Edwin T. Earl of Los Angeles. I was then a law student in the San Francisco office of Guy C. Earl, Edwin's brother. There Mr. Howells appeared one morning and, after a day in consultation, Mr. Earl and Mr. Howells adjourned to Los Angeles for further talk with Edwin T. Earl. These three men launched the enterprise. Acquisition of lands in the east arm of Big Meadows began at once.

The entire Big Meadows area was occupied at that time by large cattle and dairy ranches in the hands of pioneer families, but the east arm was deemed adequate to store all the water that could ever be used. The fall and winter months of 1901 were occupied in buying these ranches. The region was isolated, the winter severe. Snow lay deep. Travel over rough mountain roads in horse-drawn sleds was a painful experience. Arthur H. Breed, an Oakland real estate operator, came upon the scene looking for good cattle ranches. With real money in his pocket he was a welcome sight to these snow-bound folk.

March of 1902 saw the necessary lands

brought under control. The plan was still the guarded secret of a small group. Notice of appropriation of the waters of the north fork of Feather River flowing through Big Meadows was next prepared. The law at that time provided for the posting of such notice at the proposed point of diversion, and the recordation of a copy in the office of the County Recorder within ten days. Prior in time, prior in right, was the rule. Mr. Howells left early in April to post the notice at the proposed dam-site where the river, leaving the broad flat meadow land, suddenly dropped into its narrow and rapidly deepening gorge.

On the night train to Reno Mr. Howells met two men who said they were mining engineers. They did not state their business, however. At Loyaltown Mr. Howells left the train and proceeded the rest of the way by sled. At Greenville he picked up Augustus R. Bidwell, a resort-owner who had sold his Big Meadows holdings to our group and had assisted us in acquiring neighboring holdings. Mr. Bidwell was then let into the secret of the power plan. It so happened that in the snowdrifts between Greenville and Big Meadows the tongue of the sled broke and Mr. Bidwell made his way to the nearest telephone and asked Greenville to send up another sled. He was told that two strangers had left for Big Meadows in the only one available. This, of course, aroused our friends' suspicions and they immediately headed for the river, where they found fresh tracks in the snow. Clambering down the bank they posted their notice and then proceeded down stream, where they soon came upon the two alleged mining engineers in the act of posting a water notice on their own account. Mr. Howells consulted his watch and advised them that they were just one-half hour too late, that he had already posted a notice upstream. Thereupon, one of the men declared the jig up; but the other overruled his judgment and they completed their job, believing, as it later transpired, that virtue



Lake Almanor, the great power reservoir at Big Meadows.

might lie in first placing their notice on the county records. The men then departed. Our friends, divining their purpose, mended the broken sled-tongue and then separated. Mr. Howells made his way afoot across the mountains to post a notice on Butt Creek, while Mr. Bidwell took the sled, stealthily trailing the enemy over the thirty-two miles of mountain roads to Quincy, guided for hours through the darkness by the light on their conveyance. Next morning, when the county recorder opened his office, the strangers were at the door with their notice, but the recorder had another notice in his hand, given him late the night before, with the understanding that it was to be placed of record the very first thing in the morning.

Where had the leak occurred? Five years later, James D. Schuyler, an eminent Los Angeles engineer, found a box of papers in an abandoned cabin on Ohio Creek in the Big Meadows region. They proved to be letters of Dr. G. P. Cornell of Greenville, written prior to 1901, in which he outlined a scheme for hydro-electric development which

practically duplicated Mr. Howell's plan and involved the two men who had posted the rival notice. Our small group breathed more freely. There had been no leak, but a most singular coincidence.

Our camp organized Western Power Company on March 24, 1902. Our rivals organized Golden State Power Company and proceeded to acquire other properties along the river. A running fight continued up and down the stream for four years. During that period we acquired from Dr. Ray V. Pierce of Buffalo, N. Y., an option on his mining properties at Big Bend, about sixty miles down stream from Big Meadows. Guy Earl insisted that this property be acquired as a site for the first power-plant to be constructed on Feather River, because it lay below the snow-line, accessible to the markets and in position to receive the full benefit of storage at Big Meadows. But, Dr. Pierce wanted payments early and large. We found defects in his titles which afforded a reason for lengthy correspondence with his Buffalo attorney, much to the disgust of his



Constructed by the Great Western Power Company.

agent in San Francisco, Major Frank P. McLaughlin, who protested that our "long distance law" was holding up his commissions.

Meanwhile Frank L. Brown and Harley P. Wilson, of the San Francisco and New York firm of Brown, Wilson & Co., had interested Edwin T. Hawley, president of the Western Pacific Railroad Company, and a group of New York financiers in the enterprise. Money was supplied to buy the Golden State Power Company and the Big Bend properties early in 1906. Acquisition of properties in the west arm of Big Meadows was also undertaken. We felt that we had at last arrived. Then came the earthquake disaster. It shook the Eastern financiers severely. From out the ruins, Guy Earl sent them a long-hand letter urging that San Francisco was only a part of the field, that it would soon rise again, that we were in a better position than ever, for we had suffered no actual loss, whereas the electric companies in the field had lost heavily. The financiers were persuaded.

Pillsbury, Madison & Sutro were their at-

torneys in passing upon our titles. Frank D. Madison had spent months before the earthquake on this task. It had been my part to assist him with all the data and reports we had been accumulating. This mass of material lay about his office when he left on the evening of April 17, 1906. Next morning, while the fire raged, one of his assistants, B. C. Carroll, now vice-president of the Pacific Telephone and Telegraph Company, finding his safe open threw into it some charts and papers lying on his desk. All the abstracts, maps and other records—the labor of years—were destroyed. When the safe was opened a few weeks later its contents were found burned beyond recognition except for these few charts and papers at the bottom of the safe. Into them, however, had been concentrated the work of all these preceding months and from them it was possible to draft a complete report.

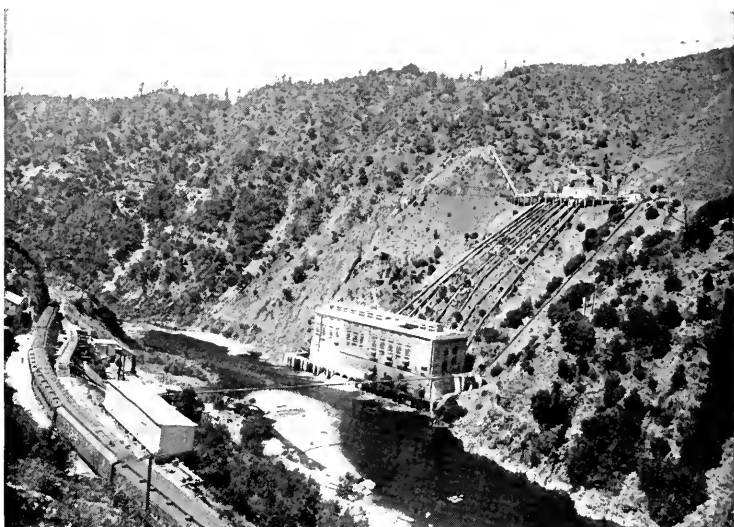
Great Western Power Company was organized September 18, 1906, and all properties were conveyed to it. Construction of the hydro-electric power plant at Big Bend now

began on a large scale. At this point the north fork of the Feather River describes a horse-shoe loop, twelve miles in circumference but only three miles through the mountain across the base. Through this Dr. Pierce had driven a tunnel to divert the waters at low flow, barring the stream-bed around the bend for mining operations. This tunnel was enlarged and used as a part of the water conduit for the power-plant.

The sale of bonds to raise funds for construction of this plant was an heroic task. One day Harley P. Wilson tried to interest an ultra-conservative Philadelphia banker, who coldly listened to his glowing tale from the Far West without ever once raising his eyes. The banker said he was not interested, but those eyes came up with a snap when a laugh broke from his visitor. Mr. Wilson hastened to explain his involuntary explosion as occasioned by the thought of his own ludicrous failure as a salesman. The banker thawed out sufficiently to explain that his bank handled only the most seasoned securities. Mr. Wilson replied that these same seasoned securities were once raw stuff, and that if every banker refused to investigate and assist meritorious new ventures soon there would be no seasoned securities for such banks as his. The upshot was that Mr. Wilson returned to New York with the Philadelphia's subscription for \$300,000 of Great Western first mortgage bonds.

All through the panic of 1907 construction proceeded without hesitation. Electricity was first delivered into Oakland from the Big Bend plant in December, 1908. The first customer was Pacific Gas and Electric Company!

The Big Bend plant, or Las Plumas, as it is generally called, for some years held pride of place as the largest hydro-electric generating plant west of the Mississippi River. Its



Las Plumas power plant, at Big Bend, on the north fork of the Feather River. The first plant constructed by the Great Western Power Company.

initial generating capacity of 53,000 horsepower was subsequently increased by the installation of additional units, until today it is rated at 91,100 horsepower. Its potential development is estimated at 174,000 horsepower generating capacity. In later years the Great Western system was augmented by the construction of the Caribou plant, located 50 miles upstream from Big Bend. This plant was completed in 1921 and today has a total generating capacity of 88,000 horsepower. Then, in 1928, the Bucks Creek power-plant, about 25 miles above Las Plumas, was put into operation. The generating capacity of this plant is, in round numbers, 70,000 horsepower.

In 1917 a forest look-out, at his station on Pilot Peak, told me of meeting Major McLaughlin and Dr. Pierce years before in the canyon of Feather River. They invited him to their picnic luncheon. Dr. Pierce introduced himself: "I guess you know who I am. I'm Dr. Ray V. Pierce of Buffalo, New York. I've sunk a million dollars in the Big Bend down the river and it looks as though I would have to go back to Buffalo and make a million dollars' worth more pills."

It was Major McLaughlin who sold the Golden Feather mining claims on the river below Big Bend to some English capitalists. His price was two hundred thousand. They stood on one hundred and fifty thousand. After some negotiation in their London of-

fices the Major yielded. The agreement was prepared and the Major summoned before the purchasers to close the deal. On reading the document his eye caught the price named—one hundred and fifty thousand pounds sterling. Solemnly and deliberately he affixed his signature.

The completion of the dam at Big Meadows was the next large undertaking. The structure as first built was sixty-five feet high, five hundred seventy feet thick at the base, six hundred twenty-five feet long and stored three hundred thousand acre-feet of water. The completed structure is one hundred fifteen feet high, thirteen hundred fifty feet thick at the base, thirteen hundred feet long, creating a lake twenty miles long, covering thirty thousand acres, and capable of storing one million three hundred thousand acre-feet of water which will one day be utilized at successive power-plants throughout practically all of its forty-five hundred foot drop.

This mountain reservoir is greater in storage capacity than all the storage reservoirs of all other power companies in this State combined. It is in one of the heaviest rainfall and snowfall areas in California and practically controls the flow of the north fork of the Feather River. When full, the reservoir covers an area of 45 square miles, practically the same as the area of the City and County of San Francisco. Measured in gallons, the customary unit for expressing capacity of reservoirs used for municipal water supplies, the capacity of Lake Almanor is 423,635,440,000 gallons, or enough water to supply San Francisco, for domestic and manufacturing purposes, for more than a quarter of a century at the present rate of consumption. If all the water Lake Almanor can hold were impounded in the area of Golden Gate Park, it would be 1,000 feet deep, or more than twice the height of the Russ Building in San Francisco.

Engineers estimate that this vast body of stored water makes possible the ultimate generation of 1,000,000 horsepower of electric energy in ten power-plants. Of this potential



Caribou power-plant, located 50 miles upstream from Big Bend.

total 246,100 horsepower has been developed to date.

Mr. Howells named Lake Almanor. He coined the word out of the names of the three daughters of Mr. and Mrs. Guy C. Earl, Alice, Martha and Elinor.

The purchase in 1911 of the City Electric Company, which brought the Fleishhacker brothers, Mortimer and Herbert, into the active direction of the company's affairs for the next fourteen years; the construction of the Caribou plant during their regime; these are events known to many and beyond the scope of this short sketch of the beginnings of things.

Pacific Gas and Electric Company and its many thousands of employees, stockholders and consumers will come more and more to a realization of the immense capacity of Lake Almanor to serve the system throughout its length and breadth, from the Oregon line to the Tehachapi.

## The Financial Side of "Pacific Service"

Following is a statement of the Company's consolidated income account for the three months ended March 31, 1931. For comparative purposes, the operations of all companies now in the consolidated system were included for both periods covered by this statement:

	3 MOS. TO MAR. 31, 1931	COMPARISON WITH FIRST QUARTER OF 1930	
		Increase	Decrease
Gross Revenue, including Miscellaneous Income.....	\$21,565,744	.....	\$228,867
Maintenance, Operating Expenses, Taxes (including Federal Taxes) and Reserves for Casualties and Uncollectible Accounts .....	9,166,794	.....	444,735
Net Income .....	\$12,398,950	\$215,868	.....
Bond Interest and Discount.....	3,922,926	156,890	.....
Balance.....	\$ 8,476,024	\$ 58,978	.....
Reserve for Depreciation.....	2,712,728	148,154	.....
Surplus.....	\$ 5,763,296	.....	\$ 89,176
Dividends Accrued on Preferred Stock.....	1,979,543	\$ 92,935	.....
Balance.....	\$ 3,783,753	.....	\$182,111
Dividends Accrued on Common Stock.....	2,860,335	\$ 53,419	.....
Balance.....	\$ 923,418	.....	\$235,530

A summarized consolidated balance sheet at March 31, 1931, follows:

### SUMMARIZED CONSOLIDATED BALANCE SHEET OF PACIFIC GAS AND ELECTRIC COMPANY AND SUBSIDIARIES MARCH 31, 1931

ASSETS		
Plants and Properties.....		\$638,885,554
Discount and Expenses on Capital Stock.....		1,645,881
Investments (including investment in Standard-Pacific Gas Line, Inc.).....		4,983,452
Sinking Fund and Other Deposits.....		1,342,041
Current Assets:		
Cash .....	\$37,067,305	
Other Current Assets.....	16,624,267	53,691,572
Deferred Charges:		
Discount and Expense on Funded Debt.....	\$17,492,002	
Unexpired Taxes and Undistributed Suspense Items.....	2,534,903	20,026,905
Total Assets.....		\$720,575,405

## LIABILITIES

Common Stock in Hands of Public (including subscriptions).....	\$155,932,632
Preferred Stock in Hands of Public (including subscriptions):	
Pacific Gas and Electric Company.....	\$109,469,157
Subsidiary Companies .....	23,613,100
Total Preferred Stock.....	133,082,257
Minority Interest in Common Stock and Surplus of Subsidiaries.....	216,900
Funded Debt:	
Pacific Gas and Electric Co., including underlying issues.....	\$234,668,200
Affiliated Companies .....	93,648,900
Total Funded Debt.....	328,317,100
Current and Accrued Liabilities.....	20,933,157
Reserves for Depreciation, Insurance and Casualties.....	54,000,301
Surplus .....	28,093,058
Total Liabilities.....	\$720,575,405

Of the cash balance of \$37,067,305 on hand at March 31, 1931, approximately \$10,500,000 was utilized for the retirement of the Great Western Power Company of California First and Refunding Mortgage Series "D"  $5\frac{1}{2}\%$  Bonds and the Yuba River Power Company First Mortgage 6% Bonds, which were called for redemption on April 1, 1931. In addition, about \$10,000,000 will be used to retire several additional issues which will be called for payment or will mature before the close of the current year. It is anticipated that the cash now in the Company's treasury will suffice not only to carry out these refinancing operations, which will result in considerable savings in annual interest charges, but also to finance all or substantially all of our construction expenditures during the remainder of the year.

### REMOVAL OF CONSTITUTIONAL LIABILITY OF STOCKHOLDERS FOR DEBTS OF CALIFORNIA CORPORATIONS

For many years the constitution of the State of California contained a section providing, in effect, that each stockholder of a California corporation shall be individually and personally liable for such proportion of its debts and liabilities incurred during the time he was a stockholder as the amount of stock owned by him bears to the entire subscribed capital stock of the corporation. A similar provision was also contained in the California civil code.

The sections of the State constitution providing for the individual liability of stockholders were repealed by an amendment adopted by the people of the State in November, 1930, and a bill recently passed the State legislature which also repealed the provisions of the California civil code with respect to this proportional liability. This bill has been approved by the Governor and will become effective about the middle of August, 1931.



# Pacific Service Magazine

PUBLISHED QUARTERLY IN THE INTERESTS OF

PACIFIC GAS AND ELECTRIC COMPANY

FREDERICK S. MYRTLE - EDITOR-IN-CHIEF

PACIFIC GAS AND ELECTRIC COMPANY

245 Market St., San Francisco

*The Pacific Gas and Electric Company desires to serve its patrons in the best possible manner. Any consumer not satisfied with his service will confer a favor upon the management by taking the matter up with the division headquarters.*

VOL. XVIII      APRIL, 1931      No. 4

In the annual review of our company's activities and accomplishments which appears elsewhere in this issue it is recorded that during 1930 there was expended in new construction work throughout the "Pacific Service" system an amount totaling nearly \$50,000,000.

This was strictly in line with our company's policy of building ahead and was made necessary by the constant increase in population and by the general expansion of agricultural, industrial and other fields of human activity which has been in process since the fertile brain of man conceived practical ways and means of enabling the people of California to profitably avail themselves of the natural resources with which this State is endowed, to a greater and more diversified extent, perhaps, than any other in the Union. It was no small task to undertake an expenditure of this magnitude in the face of a general business depression of unusual severity, at a time when there was a general slowing up of industrial and commercial enterprise, when retrenchment, rather than advancement, was the order of the day. But the Pacific Gas and Electric Company is a public service corporation and as such it is its bounden duty to provide continuous, adequate and dependable service under any and all circumstances and at the lowest possible cost to the consumer. It may not take shelter behind stress of conditions; it must at all times insure a sufficiency of supply to meet the demand for every class of service within the scope of its corporate undertaking. A public service corporation is a public servant; it must be ready when the public calls.

And so this money was spent and results have already shown, and undoubtedly will

continue to show, that it was spent wisely and in the best interests of the company's patrons. As an instance, the establishment of natural gas service in the greater part of the "Pacific Service" territory has effected remarkable reductions in the cost of service to consumers through a general decrease in the volume of consumption, natural gas having double the heating value of the manufactured product. The resultant drop in revenues from gas sales can be made up only by substantial increases in demand for all classes of gas service, and it is to this end that our company is prosecuting an arduous and unrelenting campaign of business development.

And now our company has been engaged since the first of this year in a continuance of its building activities. The budget of appropriations for new construction work in the "Pacific Service" territory during 1931 reaches an amount of, in round numbers, \$40,000,000. In the list of major projects included in the budget, the most prominent are the completion of the Mokelumne River hydro-electric project, the reconstruction of Station "A," our company's steam-electric generating plant in San Francisco, and an extension of natural gas distribution facilities.

An amount approaching \$9,000,000 will be expended upon the Mokelumne River project. The completion of Salt Springs dam and the first unit at Salt Springs power plant is estimated to cost \$2,025,000. Completion of the water conduit from Salt Springs dam to Tiger Creek is estimated to cost \$1,000,000; completion of Tiger Creek power plant, with an installed generating capacity of 80,000 horsepower, \$2,085,000; afterbay below Tiger Creek, \$350,000; road construction and maintenance, \$246,965. To transmit power generated at Tiger Creek and Salt Springs plants into the "Pacific Service" distributing system involves the expenditure of large sums, including \$52,910 on transmission lines on the development, \$43,000 on a line from Tiger Creek to Electra and \$2,357,000 upon the double-circuit 220,000-volt line, 96 miles in length, that will connect up Electra with our company's high-tension distributing station at Newark, in Alameda County. A sum of \$940,000 is appropriated to complete the alterations at Newark substation required to take care of the additional power. What is technically called the first unit of this great hydro-electric project is expected to be in operation by the early summer of this year.

A sum of approximately \$1,000,000 is set aside to complete the installation of a second generating unit of 70,000 horsepower installed capacity at Station "A" in San Francisco. The first unit was placed in operation in January of this year. An amount of \$6,620,000 has already been expended upon the reconstruction of this important station.

Upon the system of the former Great Western Power Company, now wholly merged in that of "Pacific Service," an important feature of new construction is a second circuit on the tower line from Bellota Junction, east of Stockton, to the San Joaquin Light and Power Corporation's Wilson substation, near Merced. This work calls for an expenditure of \$469,000 and involves the erection of 1,500,000 pounds of cable. When completed, this line will provide for a 220,000-volt interconnection with the Pacific Gas and Electric Company's Tiger Creek-Newark line and will, also, provide for the delivery of P. G. & E. energy into the San Joaquin Light and Power Corporation's system.

In the territory covered by the system of the San Joaquin Light and Power Corporation, at present operated as an independent company but controlled by the Pacific Gas and Electric Company, there will be an expenditure of several million dollars in new construction work. An important item on the program is the new 70,000-horsepower steam-electric generating station now under construction near Herndon, on the San Joaquin River, from which a 42-mile 220,000-volt line will connect Herndon with Wilson substation.

The appropriation allotted to the company's gas department for new construction work during the present year approximates \$8,000,000. The prominent feature of this budget is a new 26-inch gas transmission line from Milpitas to San Francisco, 51 miles in length and estimated to cost \$2,500,000. The natural gas system already operates one transmission line between the two points named, but the new one is considered a matter of necessity in order to insure an abundant supply of natural gas for San Francisco requirements. At Station "A," for instance, natural gas will displace oil as fuel for the boilers, and the two new electric generating units when operating to capacity are expected to consume from 1,300,000 cubic feet per hour up.

In addition to new construction an amount

of, in round numbers, \$13,000,000 will be required for operation and maintenance in the "Pacific Service" territory. This amount is distributed among the company's twelve territorial divisions in proportion to their several needs. It costs money to maintain as well as to establish "Pacific Service."

In the general depression of the stock market throughout the country during last year and, so far, this, the public utilities are among the few mediums of investment that have maintained anything like stability in the market. As a matter of fact, the preferred stocks of the sound utilities have been most favorably looked upon by the investor who has fought shy of scores of other propositions that appeared to hold out equally attractive inducements, measured from the standpoints of book values, earning capacities and prices quoted.

In this connection it was interesting to note an address delivered before the Essex County Chapter of the American Institute of Banking at Newark, N. J., last March by Mr. M. S. Sloan, president of the New York Edison Company and a past president of the National Electric Light Association. Mr. Sloan gave the following reasons for regarding the securities of good utilities as desirable investments:

"It is an unusually stable business.

"It is a growing business; growing with population increase; growing with the higher living standards which American ambition always produces; growing with the results of wide and intensive scientific research.

"It is a business which makes its product on customers' demands; hence has no problem of surplus goods.

"It is a business as free from labor troubles as one can be.

"It is a virile, progressive business, willing and able to avail itself of the efficiencies, economics and new sales possibilities which technical study and experimentation and research make possible.

"It is a business kept on its toes by the fact that it serves every class and group in our population, in home and place of business. Supplying a necessity of life, it is under the keenest critical observation every minute of the twenty-four hours. If that statement seems a bit broad, I refer you to the daily mail of any utility executive.

"It is a business supervised and regulated by public authority. As such it rates, its

quality of service, its capital issues are under official scrutiny, and it operates with the legal guarantee of a fair return on the value of its investment in property used for public service, if it can earn it. That qualification means much, but at least the utility has legal protection against rates which might be set so low as not to yield a fair return under proper management."

Mr. Sloan pointed out that during the year 1930, when factories were closed, there was widespread unemployment and sales fell off, the electric utilities of the nation came through the period of distress in a remarkable way. Their large power sales decreased about 8 per cent, but their sales to homes increased 14 per cent, and sales to stores, offices, theatres and other enterprises in the commercial class, for highway and street lighting and for signs and other outdoor lighting, increased also. As a result, their aggregate output of electric current decreased only about 2 per cent in volume, compared with the previous year, while their gross revenues in dollars increased about 3 per cent. This, Mr. Sloan said, was due to the fact that the sales in which they registered gains were in the higher price range of their rate schedules, while, the power business, which showed a loss, was in the low price range. The electric utilities also gained largely in the sale of electrically operated household equipment.

"I consider this record an eloquent testimony to the stability, progressiveness and the good public standing of electric utilities," declared Mr. Sloan. "By means of splendid engineering work and administrative accomplishment, utilities have made electricity universally available while steadily decreasing in price. By years of educational and selling activity, they have sold to the public the idea of using electricity. Electricity is used and will continue increasingly to be used until something better and cheaper is produced which will do the wide variety of work electricity now does. That seems a long way off."

California still ranks first among the States in rural electrification.

According to figures gathered by the Statistical Research Department of the National Electric Light Association, our State at the close of 1930 had 81,250 farms electrified. New York State came second with 61,086, Ohio third with 45,767, Washington fourth with 41,653. A big factor in California's leadership is the great amount of electric

power used in pumping for irrigation purposes. Dr. E. A. White, head of the National Committee on the Relation of Electricity to Agriculture, makes this prediction:

"Just as soon as the farmers get some of their present difficulties in better shape, whether that takes two years or five years, you will see them making demands for the extension of electric power to their homes and farms that will tax the industry to meet. It will not be a case of the electric company sending salesmen out to the farm to solicit orders; it will be a case, rather, of the electric company bending every possible effort to keep up with the multiplying demands for this service. The preliminary work of convincing the farmer that he needs electric power has all been done, done completely. The farmer knows now, better than any one else can tell him, that he needs it and he is determined to provide himself with it."

#### A BOOST FOR "PACIFIC SERVICE"

"If other large corporations of the country followed the lead of the Pacific Gas and Electric Company there would be less talk of hard times."

With those words Mr. J. L. Newman, Mayor of the town of that name in the San Joaquin Valley, in a communication addressed to our company at headquarters, expressed his appreciation of the benefits to his community derived from the recent establishment of natural gas service in the Newman district.

"We appreciate in these times," he said, "the progressive spirit of the P. G. & E., especially when other corporations are laying off their help and sitting idly by, waiting for the tide to turn. You people have faith in our community and our state and are going ahead with your constructive improvements, thereby employing thousands of men who otherwise would be out of work.

"The large corporations enjoy the respect and good will of a community, and do much to sponsor the growth of the communities in which they are active. Your corporation has taken quite an interest in the growth of our city, and your co-operation has been appreciated. We appreciate the lights you put in our park, also the assistance you have rendered us in maintaining adequate street-lighting fixtures. Your local manager is always at the head of every civic movement and co-operates with the city at any time his services are needed."

## Selling "Pacific Service" in 1931

Making new sales records and exceeding top quotas are good-sized orders under the best of circumstances. Owing to general business conditions which ushered in the year 1931, our company's sales organization was confronted with unusual problems whose solution was essential to the successful prosecution of its business development campaign. To combat these problems it was deemed advisable to materially augment the scope of the sales organization; accordingly, a program was launched to marshal the supplementary forces, so to speak, namely, the gas and electric appliance dealers, jobbers and manufacturers, as well as the rank and file employees of the company outside of the sales department.

In order to secure the greatest results from the dealer-jobber-manufacturer group, it was essential that they know the merchandising policies of the Pacific Gas and Electric Company, and the details of the sales plan and quotas which had been set up; therefore, to make them thoroughly familiar with all phases of the program, industrial meetings, attended by all of the larger dealer interests, were held in San Francisco at the beginning of the year and smaller meetings throughout various other cities and towns in the "Pacific Service" territory. In this way this very effective branch of our augmented sales organization was called into action. Not only has this dealer group been organized in the job of selling gas and electric appliances but a record has been made of every retail outlet, together with the kinds of appliances which they offer for sale, and a plan has been perfected for securing reports of the actual sales which they make. In this way the company knows exactly what the dealer branch of their sales force is doing. Over a thousand dealers are actually participating, and reports of our sales indicate clearly that they will be a factor of paramount importance in attaining our sales quotas for this year.

A novel and effective method was employed to interest, educate and inspire our non-sales employees in the form of a road show dramatizing our complete 1931 sales program under the descriptive title of "That All May Know." Members of the company's sales staff made up the personnel of the troupe, and between January 5 and January

30 this educational road show completed the circuit of all divisions of the company, carrying the message to every employee that the realization of the year's sales quota is not alone a sales department program but one in which they are entitled and expected to participate, and through such participation can increase their earnings. Through sixteen presentations this story was told to 11,575 employees, and as a result of the more complete understanding of the company's sales problems by so large a percentage of our organization, the suggestions and sales assistance rendered thus far this year have been greater than for any previous similar period.

The company's gross revenue sales quota totals \$10,855,242 for the year 1931, divided about equally between gas and electricity. Previous experience has unmistakably proven the value of domestic gas and electric loads as stabilizing factors unaffected by the general trend of industrial business. Our present efforts, therefore, place sufficient emphasis on this classification to maintain the increases which we have enjoyed and to further offset the industrial revenue decreases with which the company is confronted. Consequently our sales personnel is maintained at near 1930 levels and in excess of that of the previous year.

Of utmost importance in building our domestic load has been the advent of natural gas. The general acceptance of this fuel has been greatly accelerated by the installation of domestic natural gas conversion burners for house heating. These burners have been installed in more than 16,000 furnaces and it is our objective to increase that number to 22,800 by the end of 1931, which will represent the successful conclusion of 40 per cent of this type of potential business surveyed when natural gas was brought into the company's system.

Since the advent of natural gas, by close co-operation with gas-heating dealers our sales force has succeeded in getting a very large percentage of new heating installations to use gas rather than other fuels. At the present time it has been determined that about 85 to 90 per cent of all new domestic heating installations are gas-fired, whereas, during 1929 the company enjoyed less than 25 per cent of this business.

The estimated retail value of domestic gas appliances which will be sold to Pacific Gas and Electric Company consumers this year by all dealers and the company is \$6,497,500 and represents an annual gross revenue of approximately \$1,967,642.

The heating of apartment houses, office buildings, hotels and similar institutions takes a major place in the sales program for 1931. It is an activity which is receiving the "closest attention and this has resulted in 600 installations having been completed and in operation by March 31. The quota for the entire year contemplates 1,848 such installations, with an annual gross revenue return of \$832,000.

The industrial development of this section of California has already been materially benefited by the introduction of inexpensive natural gas. Improvement in industry will occasion a much greater use of this product, replacing liquid and solid fuels. Our industrial gas sales quota for 1931 is set at \$1,665,240. The accomplishment of this objective by the end of the year will mean securing about 50 per cent of the potential business in the industrial field. Since the latter part of 1929, when natural gas first became available, more than \$2,000,000 in annual revenue, representing about one-third of the present potential industrial market, has already been secured. Gas fuel is now being employed in nearly all classifications of western industries; i. e., canneries, chemical processes, clay, cleaning and dyeing, dairy products, enameling, food products, drying, glass, laundry, railroads, etc.

In the electrical field commercial and industrial power and light are counted upon to produce about 45 per cent of the gross annual revenue quota of \$6,091,607. In this activity government projects and various other more or less publicly financed enterprises are expected to more than make up for postponed private industrial development. Some of the outstanding projects of this type are the famous "Stockton-to-the-Sea" deep water channel project, the Oakland outer harbor development and the City and County of San Francisco water supply. Other important developments are estimated to return an annual gross revenue of more than \$20,000 in several cases and, in one instance, as much as \$60,000.

Our direct merchandising activities in domestic electric ranges, water heaters, and air heaters have been modified this year to main-

tain the same degree of creative effort on the part of the salesmen and, at the same time, to encourage and assist the dealer outlets. Our revenue quota in this activity amounts to \$831,610 and represents a total merchandise value of \$2,594,130. The second quarter of the year will feature a major activity, the "Fifth Annual PG&E Range Campaign." Special features to stimulate and sustain salesmen and general employee interest will be emphasized and the objective will be to secure approximately one-third of the annual revenue quota.

Another important activity is the "Spring Dealer Electric Refrigeration Campaign," intended to add to our lines 10,500 refrigerators, which will represent a revenue return of \$241,000 annually. This is a co-operative campaign, the refrigerators being sold by dealers only, but is supported by the company to the extent of institutional newspaper advertising and employee prospect assistance. For the year it is expected that in excess of 29,500 electric refrigerators will be sold on the Pacific Gas and Electric Company lines, thereby creating new revenue amounting to approximately \$659,000 annually. The realization of this refrigerator sales volume will be materially aided by a very comprehensive and well-planned national program sponsored by the National Electric Light Association. It is anticipated that our quota of \$989,000 gross annual revenue will be secured from the sale of refrigerators and other convenience outlet electric appliances which are sold only by dealers and will involve an estimated retail merchandise value of almost \$20,000,000.

The balance of the electric sales quota for 1931 will be secured from agricultural and rural power, creative lighting, industrial heating and commercial electric cooking and baking. Our sales staff is continually creating increased demands for electricity by acquainting customers with the outstanding advantages which it can give them, and by further explaining to them new uses and improvements in working conditions and in products which may be secured.

This business development campaign as outlined is being prosecuted throughout the entire territory covered by the operations of the Pacific Gas and Electric Company and its affiliated companies, including the Great Western Power Company, San Joaquin Light and Power Corporation and Midland Counties Public Service Corporation.

# PACIFIC GAS AND ELECTRIC COMPANY

A CALIFORNIA CORPORATION

Managed by Californians

Operated by Californians

THE CONSOLIDATED "PACIFIC SERVICE" SYSTEM REPRESENTS (as of December 31, 1930)

15,770 employed in all departments.

\$628,000,000 capital invested in gas, electricity, street railway, steam and water plants.

85,000 square miles of territory in which it operates — an area greater than that of England and Wales.

85,000 stockholders.

45 counties of the State in which it transacts business.

1,244,606 consumers served with gas, electricity, water and steam.

2,750,000 people in 45 counties, which is approximately 50 per cent of the State population.

618 cities and towns in which it supplies service directly and through other companies.

\$29,773,000 annual wages paid employees, year ending December 31, 1930.

\$8,296,000 taxes, Federal, State, county and local, year ending December 31, 1930.

1,082,632 horsepower developed in 48 electric water-power plants.

421,715 horsepower developed in 15 electric steam plants.

1,504,347 total horsepower developed in 63 plants.

3,286,619,000 kw. hours sold, year ending December 31, 1930. This is equivalent to the effort of 10,955,000 men.

23,017,230,000 cubic feet of gas sold, year ending December 31, 1930.

33,397 miles of electric transmission and distribution lines. Greater than the distance around the earth.

6,931 miles of mains used in distributing gas. Greater than the distance between San Francisco and Oslo, Norway.

955 miles of mains and ditches used in distributing power.

1,370 miles of track of railway supplied with electric power.

616,395,950,000 gallons of water storage capacity of 115 lakes and reservoirs. This amount of water would supply the City of San Francisco at the present rate of consumption for approximately 34 years.

216,561 acres of land owned in California.

571 parcels of property owned in cities and towns.

576,423 horsepower in agricultural motors depending on "Pacific Service."

1,304,937 horsepower in mining, electric railways, manufacturing and other motors depending on "Pacific Service."

19,923,300 incandescent lamps nightly lighted.

3,640,443 horsepower connected to system.

PACIFIC GAS AND ELECTRIC COMPANY

General Offices: 245 Market Street

San Francisco

Branches in all principal cities and towns of 45 counties of North Central California.



*Salt Springs Dam, largest rock-fill dam in the world, is a feature of the Company's Mokelumne River development.*

# When you buy—

*Pacific Gas and Electric Company First Preferred Stock*  
you know that you are investing in a *safe, marketable*  
*security yielding an assured income;*

**And You Have the Added Satisfaction** of knowing that your money is usefully employed in a basic industry furnishing services essential to industrial and commercial progress and domestic comfort and convenience.

Projects such as the Company's Mokelumne River development furnish employment to thousands of men, and are an important and enduring contribution to the continued advancement of the territory served.

The Company is now offering a limited amount of its First Preferred  $5\frac{1}{2}\%$  Stock for sale direct to its customers and other residents of territory served.

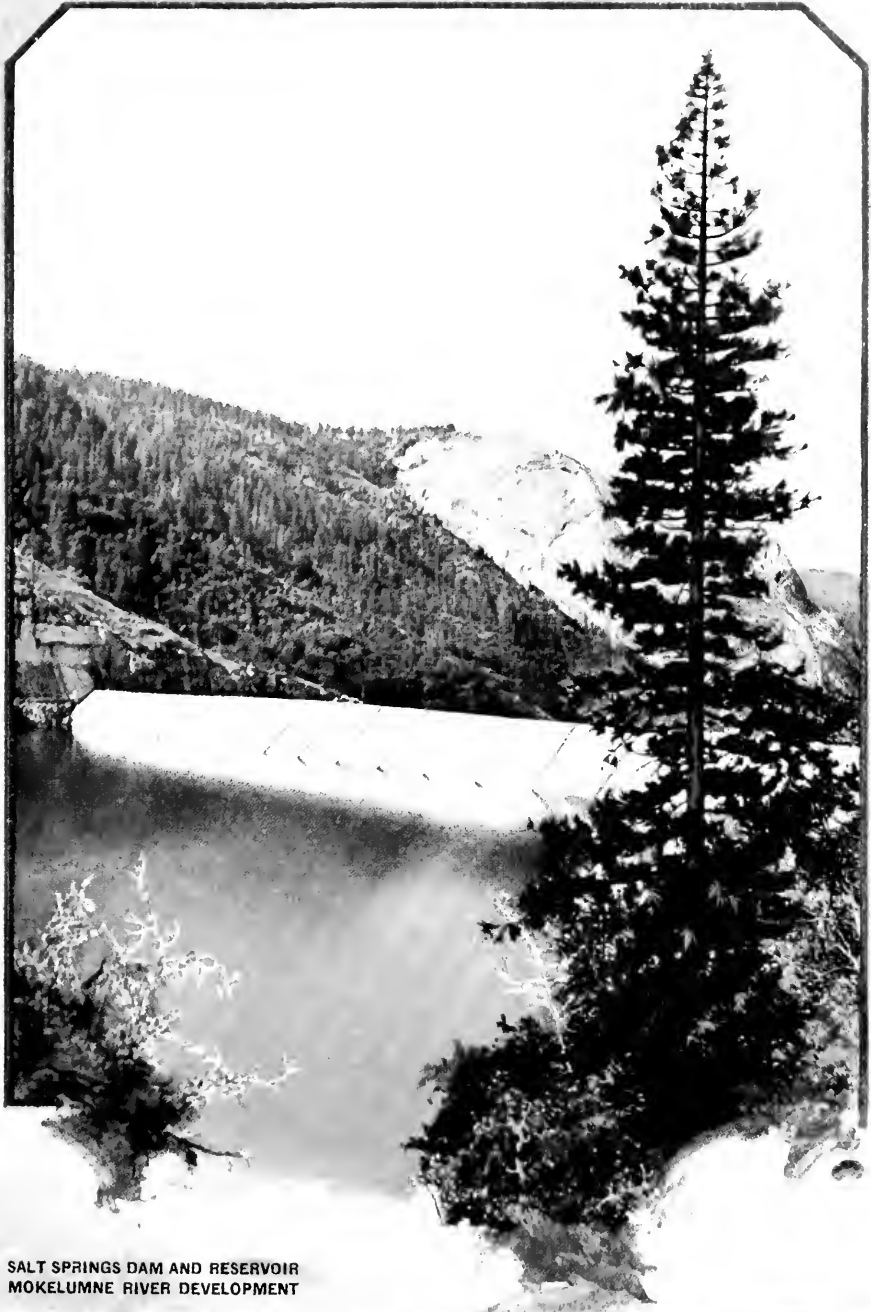
Circular descriptive of this investment issue will be mailed upon request.

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**PACIFIC GAS AND ELECTRIC COMPANY**  
Stock Sales Dept.   ✦   245 Market Street   ✦   San Francisco

# PACIFIC SERVICE MAGAZINE



SALT SPRINGS DAM AND RESERVOIR  
MOKELUMNE RIVER DEVELOPMENT

Vol  
18

JULY 1931

No  
5

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# Pacific Service Magazine

Volume XVIII

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Number 5

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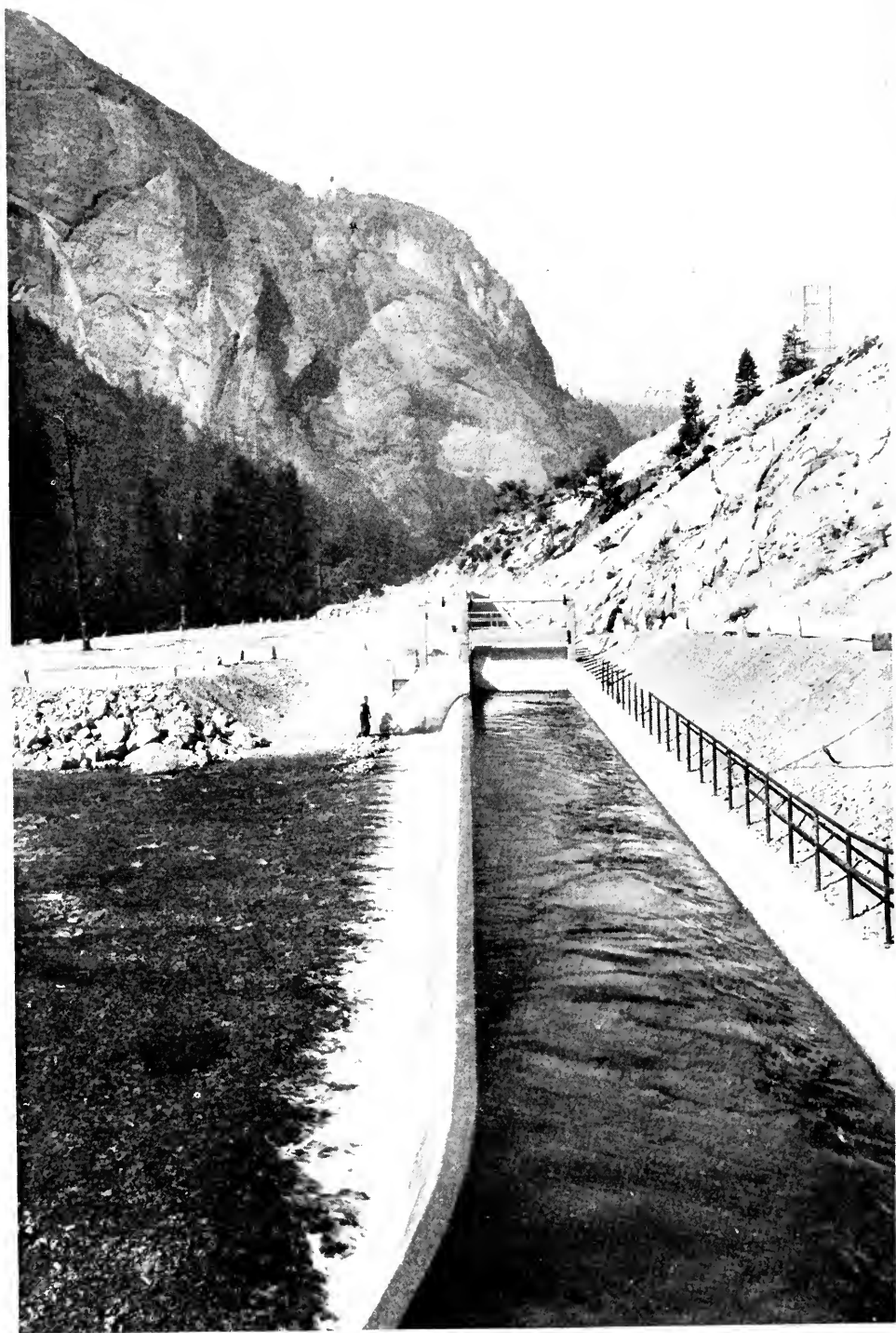
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Tiger Creek water conduit leaving Salt Springs power-house. Mokelumne River development.

# PACIFIC SERVICE MAGAZINE

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## Mokelumne River Project Officially Placed in Service

*Two hundred journalists from Northern California accompanied P. G. & E. officials to opening ceremonies at Salt Springs and Tiger Creek. Job completed well within schedule time.*

By FREDERICK S. MYRTLE

The Mokelumne River development, our company's latest important hydro-electric project for the extension of electric service facilities to consumers in the "Pacific Service" territory, is now in operation.

What is technically termed the first unit of the development was officially placed in service on Sunday, July 12th, in the presence of a gathering of company officials and some 200 newspaper editors from various sections of northern and central California who were specially invited to make the trip for the pur-

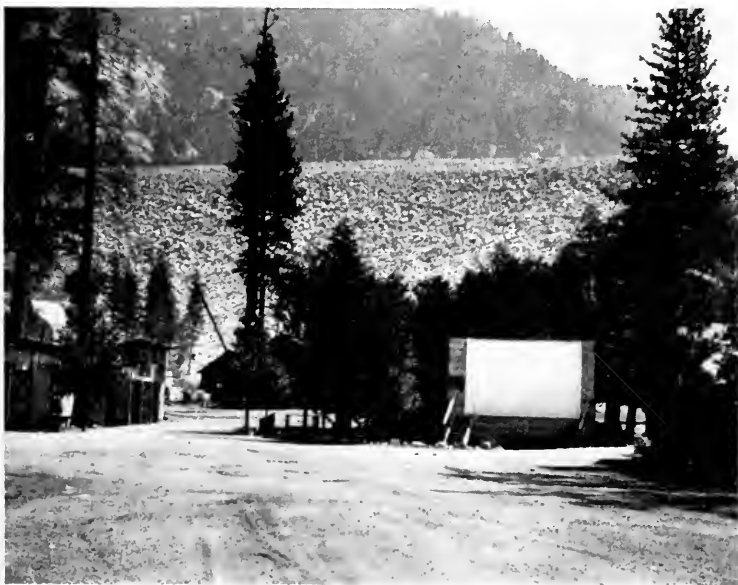
pose of enabling them to see for themselves the result of five years' labor upon a project which, when carried to its ultimate stage of completion, will contribute 229,000 horsepower in installed capacity to our company's electric generating and distributing system whose interconnected transmission lines now extend from the extreme north of the State to the southern end of the San Joaquin Valley.

The following major features constitute this first unit of the development:

Salt Springs dam, a rock-fill structure 330 feet in height, 1300 feet along the crest, 900 feet thick at the base, containing 3,000,000 cubic yards of granite. The largest dam of its type in the world.

Salt Springs reservoir, created by the dam. Maximum storage capacity, 130,000 acre-feet.

Salt Springs power plant, located on the north bank of the stream immediately below the dam and operated by water



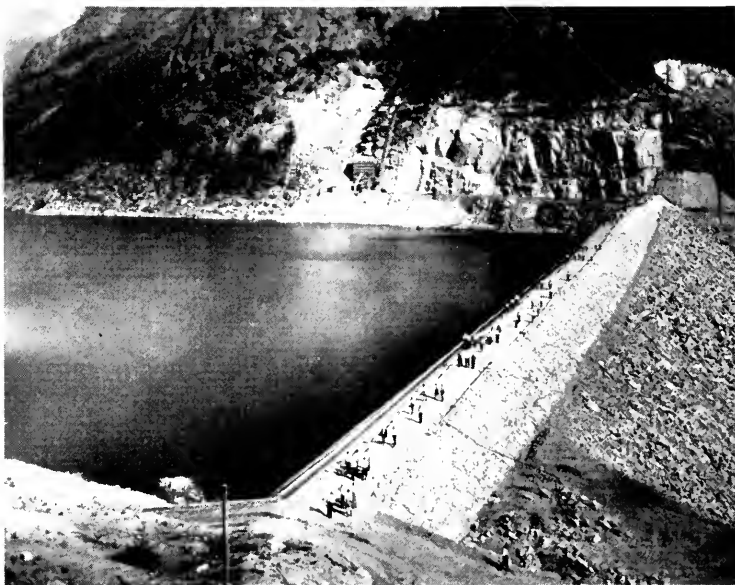
View of Salt Springs dam from the construction camp.

from the reservoir by means of a tunnel bored through the north abutment of the dam. Present installed capacity, 15,000 horsepower.

Salt Springs-Tiger Creek water conduit, approximately  $20\frac{1}{4}$  miles in length, consisting of  $17\frac{1}{4}$  miles of reinforced concrete flume,  $2\frac{3}{4}$  miles of tunnels, seven in number, and two steel siphons spanning ravines.

Tiger Creek power-plant, situated on the north bank of the Mokelumne River near the point where it is joined by Tiger Creek. Installed capacity, 80,000 horsepower.

Sixteen and one-half miles of 100,000-volt electric transmission line from Salt Springs to Tiger Creek and 108 miles of double-



Our visitors inspecting the big dam at Salt Springs.

circuit 220,000-volt line from Tiger Creek to our company's high-tension distributing station at Newark, Alameda County. Also, a branch 220,000-volt line leaving the other at Bellota, a point twelve miles east of Stockton, and running down valley a distance of 98 miles to connect with the San Joaquin Light and Power Corporation's recently constructed high-tension substation at Hernon, near Fresno.

The completion of this first unit, then, means that 95,000 horsepower of installed capacity has been added to the combined hydro-electric generating resources of the "Pacific Service" system. From the very first instant of their official opening Salt Springs and Tiger Creek plants have poured an unceasing volume of



View of Salt Springs reservoir at time of opening.

electric energy into the "Pacific Service" power pool. At the time of writing both plants are operating to full capacity.

To bring this great hydro-electric project to final completion, following are the major features of the work yet to be accomplished:

Construction of an additional dam on Bear River, on the north or Amador ridge above the Mokelumne and at an elevation of 2,000 feet above Salt Springs power plant, water from which will be used to operate a second unit at Salt Springs power-house of about 34,000 horsepower generating capacity. Estimated storage capacity of the new reservoir, 50,000 acre-feet.

Construction of a power plant of 20,000



Salt Springs power-house, just below the dam.

horsepower capacity at West Point, on the main river five miles below Tiger Creek.

Construction of an entirely new power plant, of 80,000 horsepower capacity, and identical in construction with that at Tiger Creek, at Electra, this to take the place of the 26,000-horsepower plant at that point which has done service since 1902.

Electra comes into the picture from the standpoint of historical interest as well as of utility. The system of which it is the central feature harks back to before the beginning of the present century, to the incorporation, in 1890, of the Blue Lakes Water Company with its cluster of reservoirs in Alpine County feeding into the Mokelumne River. These formed the nucleus of the Electra system which, constructed by the Standard Electric Company, one of the predecessor companies of "Pacific Service," was operated from the first by water from these reservoirs, helped out by a number of tributary streams discharging into the Mokelumne en route, such as Bear River, on which a reservoir of moderate capacity was built, Cold Creek, Deer Creek, East and West Panther Creek and Tiger Creek. All these sources of water supply are embraced in the present Mokelumne River project, which is practically an extension and enlargement of the old Electra system, with modern construction and equipment, modern storage and electric transmis-



First unit installed at Salt Springs power-house.

sion facilities.

Concerning the construction work yet to be accomplished our company's Engineering Department estimates that, if the present plans are carried out according to schedule, the Electra plant, the first to be undertaken, will be in operation by 1934, West Point plant by 1935 and the new Bear River reservoir by 1936.

The estimated cost of the entire project is around \$40,000,000, of which \$25,000,000 has been expended to date. It has been a high quality job from the start, the construction work improving as it progressed. The company's Department of Engineering, in charge of Vice-President A. H. Markwart, was responsible for all plans, designs and engineering features. Construction work was carried on by the General Construction Department, under Mr. O. W. Peterson. Some idea of the remarkable accuracy of the construction estimates in point of time is afforded by the fact that the various sections of the work were so well synchronized that they were completed not only within the time set, July 1st of this year, but within

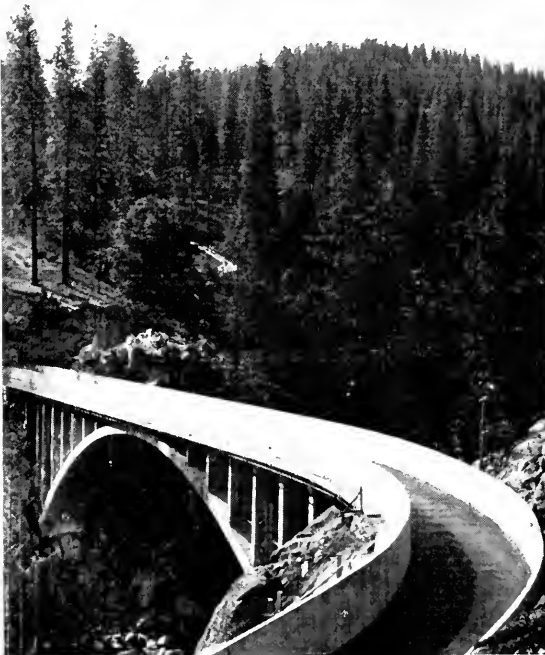


Transmission tower below Salt Springs.

comparatively few days of one another.

The big dam, for instance, was completed and started to fill in March and water was drawn from it in June for experimental tests. Salt Springs power-house was tested out in the middle of June. Completion of other sections of the job followed in rapid order and on Sunday, June 28th, the final tests were made at Tiger Creek power-house. The generators were set in motion, the transformers brought into play for the stepping up of the power, the transmission lines charged and connection effected with the far-away distributing stations at Newark and Herndon. All ready to go.

Another matter worth more than passing mention in connection with the Mokelumne River development is the "buy at home" policy that was steadfastly adhered to by our company in this, as indeed, in all its major construction achievements of recent years. Whenever possible, all machinery and supplies were purchased from California corporations and firms, so that, to say nothing of labor on the ground,



Conduit arch span over Bear River.

employment in the manufacture of the finished product from raw material was provided for many thousands of workers in Northern California industries.

It is estimated that from first to last approximately 200,000 tons of material and machinery were received by rail at Martell, the receiving station at the end of the branch railroad running out from the Southern Pacific main line at Galt. From Martell material and supplies were trucked out along the Alpine highway to the scene of action. Allowing 40,000 pounds to a car

this would make about 5,000 carloads. A fair estimate would designate 95 per cent, or all but 250 carloads, as being of California manufacture. The following northern

California firms furnished substantial amounts of machinery, construction equipment and supplies for the development:

Pelton Water Wheel Company, San Francisco, water wheel and governors.

General Electric Company, Oakland shops, the main switchboard at Tiger Creek.

Pacific Electric Manufacturing Company, San Francisco, circuit breakers.

Herrick Iron Works, Oakland, structural steel frame work.

Columbia Steel Company, Pittsburg, California, reinforcing steel.

Western Iron Works, San Francisco, miscellaneous structural steel.

Steel Tank & Pipe Company, Berkeley, steel pipe and frames.

Judson-Pacific Company, San Francisco, two 100-ton cranes.

Joshua Hendy Iron Works, Sunnysvale, California, main gate valves, castings, penstock fittings and main wheel gate for Tiger Creek.

Pacific Coast Steel Company, South San Francisco, 220,000-k.v. bus structures, transmission line towers and reinforcing steel.



Water conduit at entrance to Cold Creek tunnel.



Conduit crossing Alder Creek gulch.

Union Planing Mill, Inc., Stockton, mill work.

Miller-Hayes Company, Stockton, copper roofing and sheet metal work.

Herman Bosch, San Francisco, power-house plaster.

Smith Glass Company, San Francisco, window glazing.

W. P. Fuller Company, General Paint Company and Wailes-Dove-Hermiston Company, San Francisco, paint for buildings and penstock pipe.

Western Pipe and Steel Company, San Francisco, penstock line.

Fisher Brothers, Stockton, mill work on operators' cottages.

Northern California Cement Companies, all cement for use on the job.

Mutual Engineering Company, South San Francisco, special construction equipment.

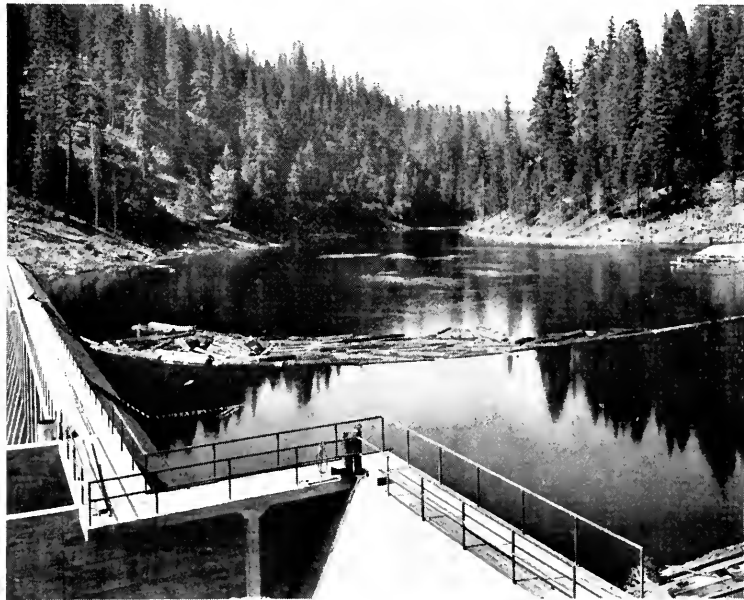
Practically all commissary supplies were purchased from Sacramento firms.

The trip to the opening ceremonies started on Friday, July 10th. Our journalist guests were escorted from their various places of residence by company district managers, every section of the P. G. & E. territory being represented. For purposes of convenience, two assembling points were selected, Stockton and Sacramento. Dinner, followed by various forms of entertainment, consti-



View of the conduit near Tiger Creek.

tuted the evening program and at an early hour on Saturday morning the start to Salt Springs was made. Public motor coaches were the means of conveyance. The complete party numbered 297, and 19 coaches were used. They made an imposing procession.

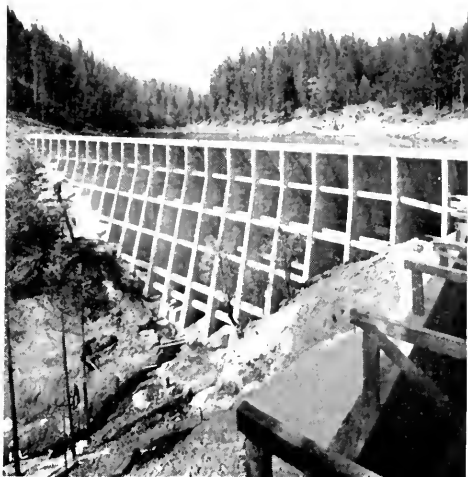


Tiger Creek regulator dam and reservoir.

Both divisions traveled out by the Stockton-Sacramento highway, then coming together at Twin Cities, whence the way led by lone to Martell and thence along the Alpine Highway. Then came the climb to the mountain altitudes. It was a hot ride and a welcome stop was made at Barton's, where lemonade stands invited patronage. From a ranger station, 40 miles along the highway,

measured from Jackson, the county seat of Amador, and at an elevation of 6,750 feet above sea level, the first road into Salt Springs was built in the early construction period and it was decided to make use of this so that the Tiger Creek road, which our company subsequently built as the easier and better means of approach, would not have to be traveled twice. The coaches ground their way down the steep slope comfortably, and Salt Springs construction camp was reached in time for lunch.

From the ground level of this camp one obtains, I think, the most striking impression of the height and immensity of the big dam that stretches out in all its imposing grandeur but a few hundred feet away. The whole scene, too, is impressive to a degree. The Mokelumne River that moves leisurely past the construction camp on its way oceanward divides the counties of Amador and Calaveras, and along the summit of the north or Amador ridge, 3,000 feet above the stream, runs the Alpine Highway from which the descent has just been made. Then one begins to realize the immensity of the task that confronted our company's engineers when first they planned to invade this solitary spot where few men had traveled before. The site of the construction camp is called Dead Man's Flat, for the reason that a solitary grave marks the last resting place



Down-stream face of regulator dam.

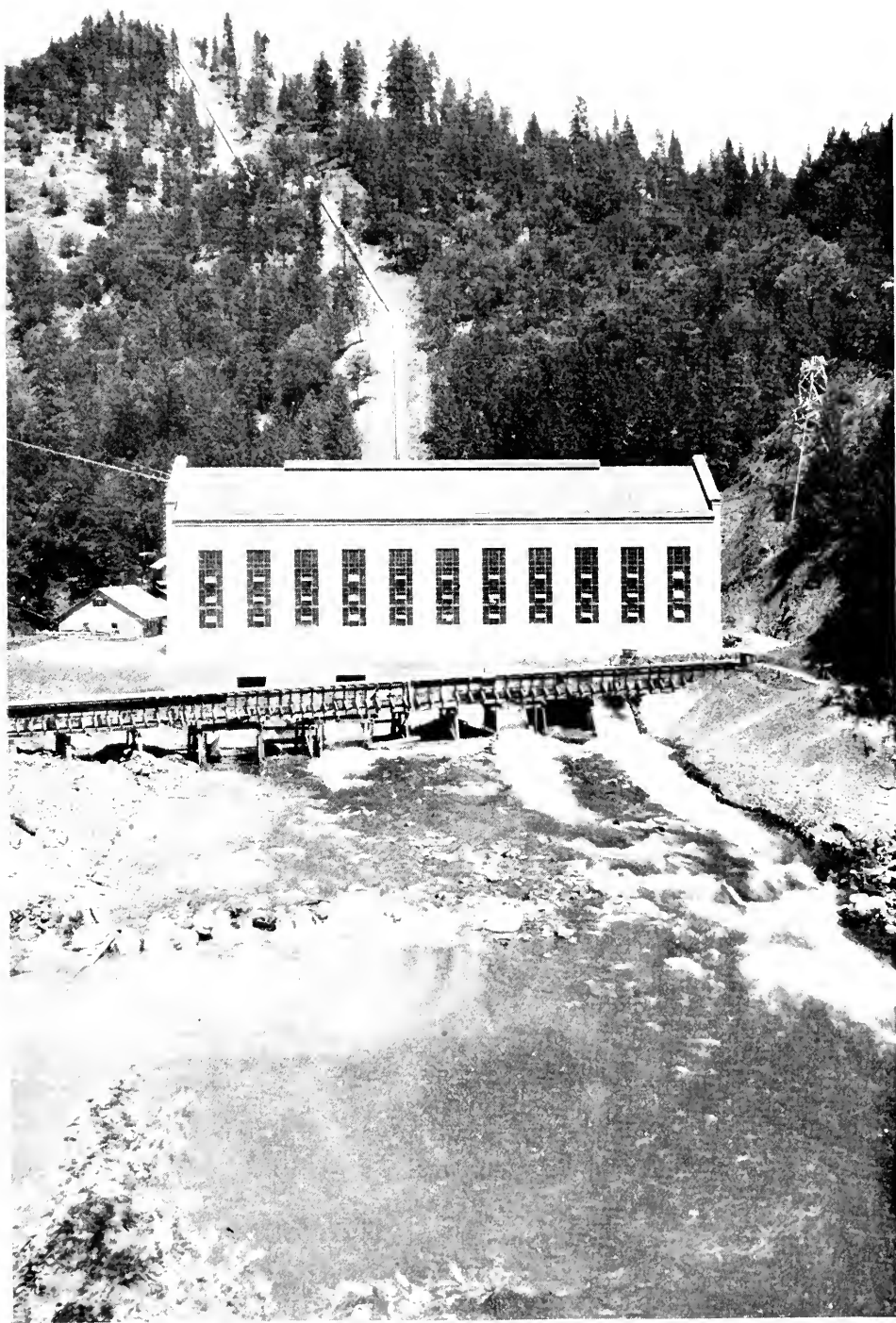
of an adventurous spirit of the early days. For over thirty years he lay there before human voices awakened echoes from the hills around.

After lunch the party inspected Salt Springs dam, reservoir and power-house.

Hot work, relieved by more lemonade. A wooden stairway had been built to the top of the dam and over the crest our visitors roamed at will. Company officials gave brief descriptions of the construction work involved. It was, perhaps, a matter of no small surprise to see a reservoir of approximately 90,000 acre-feet backing up against the dam. Short of full capacity, of course, but it seemed wonder-



Tiger Creek forebay, at head of penstock.



Tiger Creek power plant. Installed generating capacity, 80,000 horsepower.

ful in view of what had been heard about water conditions after a succession of dry winters. This reservoir, when full, will be four miles in length.

Salt Springs power-house attracted attention. It is of modern construction, tall and roomy, and from it the concrete flume that carries the water to Tiger Creek starts on its downstream way.

In the evening there was supper, followed by an out-of-doors entertainment presided over by Mr. Al C. Joy, Manager of Publicity Department. Among the features were congratulatory addresses by guests and descriptive talks by company officials, also motion pictures of the development. Mr. A. F. Hockenbeamer, our company's president, took pleasure in welcoming the party to Salt Springs and in the course of an instructive address emphasized the fact that Pacific Gas

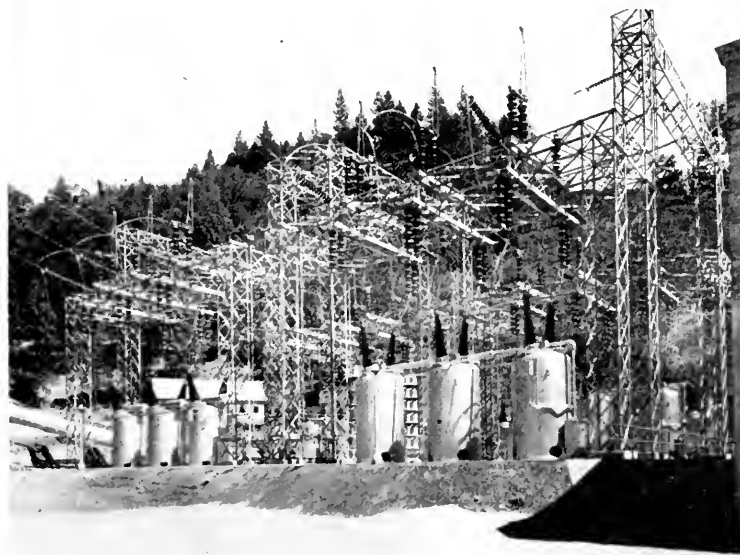


Interior of Tiger Creek power-house.

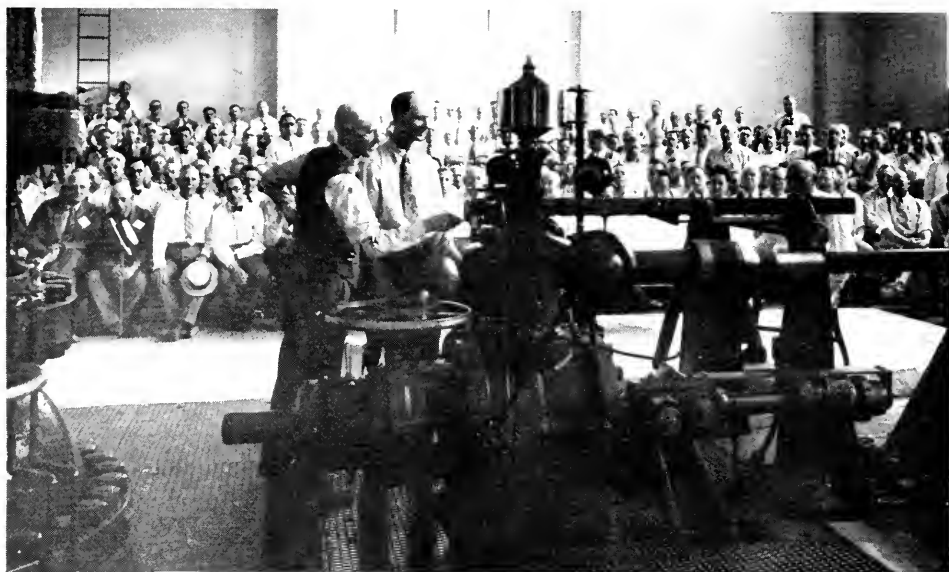
and Electric Company is, in every sense of the word, California owned as well as operated. He showed that California stockholders owned the greater part of the company's outstanding securities and expressed the opinion that there was small likelihood that at any time within the lifetime of anyone in his hearing would the control of "Pacific Service" pass from where it now rests. He declared the recent purchase of the Great Western and San Joaquin companies to be an instance of taking two valuable links in the

great California power chain out of Eastern control and bringing them back to California where they belong.

Our company's first vice-president and general manager, Mr. P. M. Downing, spoke for the great system that is "Pacific Service." He instanced the wide interconnection of transmission lines so systematized that one man, the company's load dispatcher, from a little office in Oakland controls



220,000-volt outdoor transmission structure at Tiger Creek.



Mr. Irving Martin starting up the machinery at Tiger Creek power-house.

the entire output of power from whatever station in the "Pacific Service" territory. No plant can be shut down, no change whatever made in the load, without his knowledge and authority. The result is found in reliable service, besides accuracy and economy of operation. Mr. Downing spoke of the big work that had been recently brought to part completion and extended his congratulations to the men of the company who had been mainly responsible for its success. As he spoke he must have felt himself on familiar ground in more ways than one, for at the outset of his career as an engineer he was employed by the old Blue Lakes Water Company as superintendent of its hydro-electric plant near Electra, which was built for the supply of mines on the Mother Lode in Amador County and was one of the first hydro-electric plants constructed in the State of California.

Another speaker was Mr. O. W. Peterson, the construction engineer who built the development. He described briefly the progress of the job from the beginning and gave credit to a number of engineers and men of the company who had contributed to its successful completion. Mr. Peterson also called attention to the fact that there was comparatively little sickness among the men in camp and an entire absence of crime during the construction period.

The night was spent at Salt Springs, the

party being distributed among the various bunk houses that lined the Calaveras hillside. Early on Sunday morning, a start was made for Tiger Creek. The route taken was along the broad construction road previously referred to. This, for the most part, follows the contours of the streams and the concrete flume is in evidence the greater part of the way.

Our visitors were much interested in the flume, a box-like structure which is laid upon a prepared bed and is a radical departure from the old-fashioned ditch or wooden flume. From its unusual method of construction and the way it is laid it would appear that the conduit is protected from bank-caving, debris and other troubles that have been known to beset the open ditch. Our visitors were shown the various methods employed to convey the water across ravines and streambeds. Particular features of interest were the crossings at Bear River and Alder Creek, each with a single arch span, and the siphon laid across Deer Creek gulch. Another feature worthy of mention was the Tiger Creek sawmill, which played an important part in the construction of the old Electra power development at the beginning of the present century. For over twenty-five years it lay idle until work upon the present development caused it to be recalled to active service, and it is credited with a turnout of 25,000 feet of lumber per day, on an aver-

age, for construction purposes.

Comparatively slow progress was made in this morning journey for the reason that the road has many turns and some ups and downs. There are two considerable ridges to be surmounted, notably that leading to Panther Creek. Through this the water is conveyed by a 9,200-foot tunnel. Tiger Creek was reached about noon and the party assembled in the power-house for the formal opening of the plant. President Hockenbeamer made a short address, calling attention to the fact that this, as, indeed, all other sections of the development, had been built, as far as possible, out of materials supplied by California firms. He read out names from the list which appears elsewhere.

Mr. J. P. Jollyman, chief of the division of hydro-electric and transmission engineering, gave the gathering an insight into the engineering features of the job, describing the method by which water was conveyed to the operating machinery, the power generators stepped up and transmitted into the system.

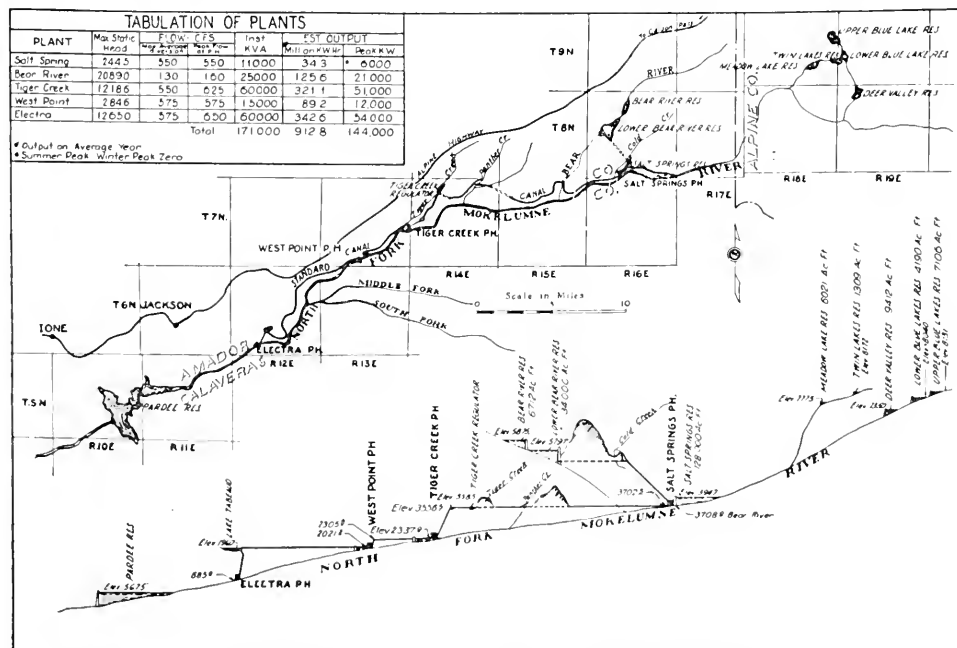
An interesting interlude was an address by Mr. A. G. Wishon, a pioneer developer of electric power in the San Joaquin Valley and who was instrumental in organizing the San Joaquin Light and Power Corporation.

His company, as is generally known, is now affiliated with Pacific Gas and Electric Company, and there is a complete interconnection of transmission systems.

Mr. Irving Martin, of the *Stockton Record*, was invited to perform the ceremony of placing the plant in operation. In the course of a pleasant address of congratulation he referred to the company's policy of inviting inspection of all its records and achievements. When all was ready, Mr. Martin opened the valve which discharged water from the penstock onto the buckets of the big waterwheels connected to the generators. In a few seconds the wheels were going at full speed. Then Mr. Martin closed the switch that turned the power into the transmission system.

"I am glad to see this. We need the power badly at Herndon," observed Mr. A. G. Wishon to the writer. Even as he spoke the first batch of much-needed kilowatts was already being received at the San Joaquin station near Fresno.

A brief inspection of the plant was followed by luncheon. Then came the journey home. The motor coaches conveyed their original occupants to Stockton and Sacramento, and from those points our visitors were escorted home by company officials.



Plan and profile map of the Mokelumne River development.

## Extensions at Newark Substation to Accommodate New Power Supply

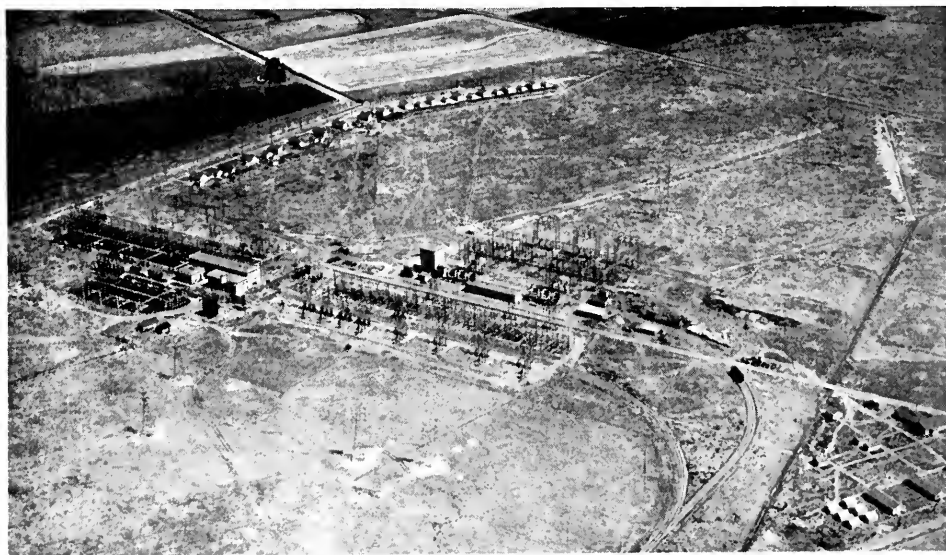
By J. P. JOLLYMAN, Chief of Hydro-electric and Transmission Engineering

Following the decision to proceed with the comprehensive development of the hydro-electric resources of the Mokelumne River, a study was made to determine the best location for the substation through which the power would be distributed. The distribution of the load by geographic districts was determined. The sources of supply and the rate of growth for each district were considered. The districts bordering the south end of San Francisco Bay were found to be those in which the additional power could best be used.

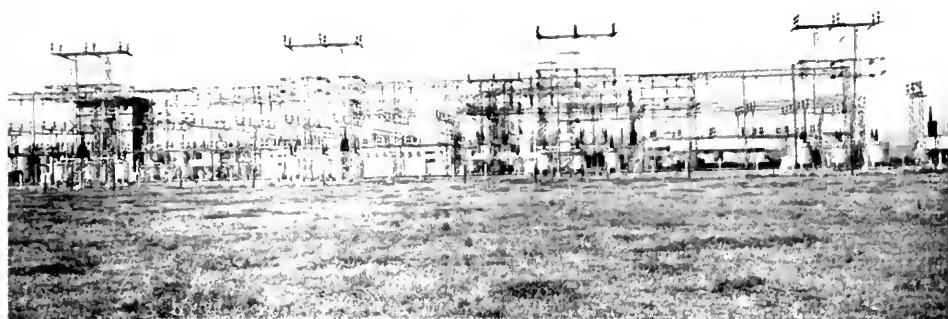
The ultimate development of the Mokelumne River project is expected to reach an installed capacity of 229,000 electrical horsepower. Of this, 15,000 horsepower will be supplied to the 60,000-volt line now fed by Electra power plant. To take care of the remaining 214,000 horsepower required transmission facilities considerably in excess of those afforded by the existing lines and substation equipment.

An investigation was made to determine the voltage which would transmit this amount of power in the most economical manner. 110,000 volts and 220,000 volts were considered. The costs of construction for the two voltages were about the same, but the efficiency of the 220,000-volt transmission was better; also, it had a considerable margin of capacity which the 110,000-volt lines would not have. 220,000 volts was, therefore, adopted for the Mokelumne transmission line. A double-circuit line was selected to insure continuity of service.

Newark substation, the company's high-voltage distributing station at the south end of the bay, suggested itself as the logical site for the new distributing station. Newark was then receiving power at 110,000 volts from Drum and the other South Yuba-Bear River hydro-electric plants, and from Electra at 60,000 volts. Outgoing power was transmitted by 110,000-volt lines extending from Newark to Oakland, San Francisco,



Airplane view of Newark substation—new construction to right of buildings.



Newark substation. View of outgoing 100-k.v. lines.

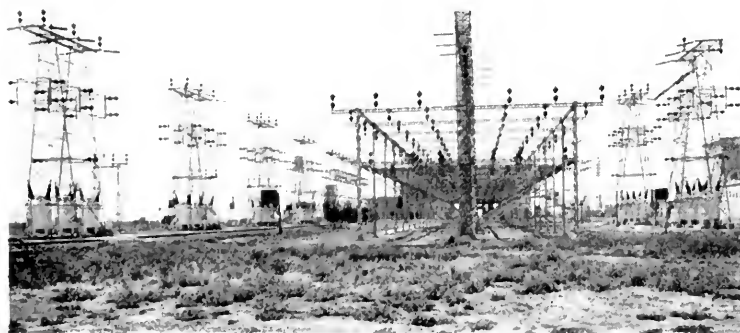
San Jose and Salinas, and by 60,000-volt lines traveling down the Peninsula. The 110,000-volt Sierra line from the Stanislaus hydro-electric plants to San Francisco passed nearby. By looping this latter line into Newark an opportunity was afforded of securing increased transmission capacity to San Francisco as well as effecting a closer co-ordination of the Sierra system with the other properties of the company.

Some 200,000 horsepower was then passing through Newark. To add 214,000 horsepower from the Mokelumne project and to tie in the Sierra group with over 80,000 horsepower would overload the existing equipment and threaten widespread inter-

ruption to service should any failure occur. It was therefore determined to divide the ultimate station into two electrical units which would be connected by an electrical safety device known as a bus reactor. The bus reactor limits the flow of power from one unit of the station to the other to the comparatively small amount required to balance the incoming and outgoing power of each unit. It is the electrical equivalent of a small pipe connecting two large water systems. The small pipe permits the small amount of water needed for the equalization of the needs of the two systems to flow but limits the amount that either system can contribute to the other in the event of a broken main.

While the substation was divided into two electrical units, the switchboards controlling each were placed in a single room and so arranged that the attendants could observe the conditions of each unit and the power exchanged from one unit to the other.

The equipment for the transformation, regulation

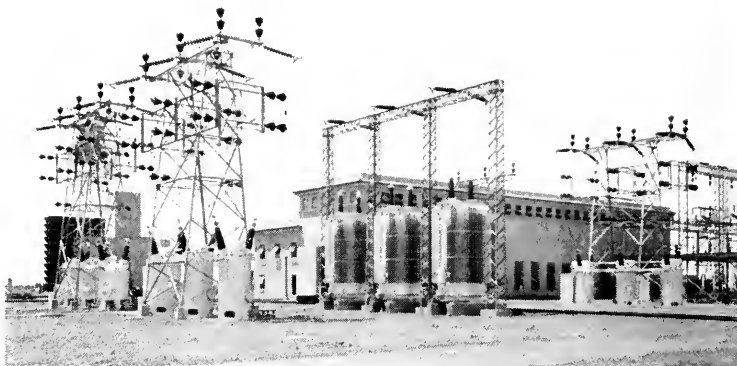


East end of 100-k.v. bus structure—circuit-breakers on either side.

and distribution of the Mokelumne power would have constituted as large a substation as any on the system. When added to the existing station, it makes Newark much the largest substation of the Pacific Gas and Electric Company and one of the most important electrical centers in the world, with an aggregate transformer capacity of 262,000 horsepower. Eleven steel tower lines carrying twenty-one circuits of 60,000, 110,000 or 220,000 volts radiate from this station and connect it to every important group of hydro-electric plants and to the large steam electric plants in San Francisco and in Oakland.

A double 220,000-volt bus has been constructed for six circuits. Two sections will receive the power from the Tiger Creek-Newark circuits, three sections will feed the three main 220,000-volt to 110,000-volt transformer banks, of which two are now installed, and one provides for the bus tie switch. An additional section was provided for the coupling condensers of the carrier current telephone.

The 220,000-volt, 110,000-volt and 60,000-volt bus structures at Newark are a type

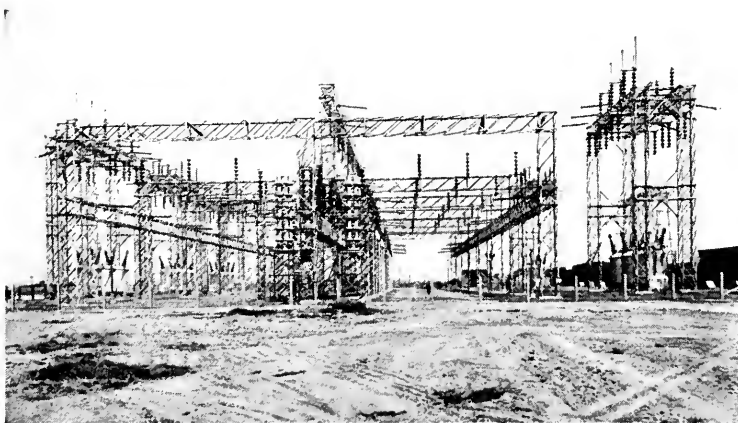


110,000-volt bus reactors. Oil circuit-breakers at either side.

which provides one oil circuit-breaker per circuit and one bus tie oil circuit-breaker which may be substituted for any other. All necessary flexibility is provided with a minimum number of oil circuit-breakers. This type has been extensively used by the company in its important stations with marked economy. The 220,000-volt bus structure at Newark is the first of this voltage to be constructed.

Two banks of main transformers are provided, with provision for a third bank in the ultimate installation. Each bank has a capacity of 72,500-horsepower. Power is received at 220,000 volts and transformed to 110,000 volts. A third winding of 11,000 volts permits the operation of synchronous condensers for voltage regulation. The efficiency of transformers has been materially improved in the past few years, air-cooling

of large units taking the place of water-cooling devices previously used. The transformers, therefore, were made air-cooled. Radiators are used to dissipate the heat arising from the losses. Cooling is assisted by fans applied to each radiator and used during periods of heavy load or high air temperatures. Each trans-



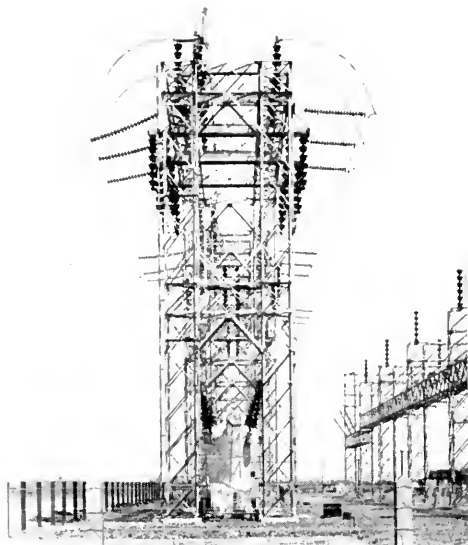
West end of 220-k.v. bus structure at Newark.

former weighs nearly 100 tons. Each is mounted on an eight-wheel truck which permits it being rolled onto a transfer car for movement into the transformer handling house. Some idea of their size may be had from the door in the handling house, which is 18 feet wide and 35 feet high.

The transformer handling house is a steel frame, concrete wall structure 33 by 40 feet, 58 feet high. It is equipped with a 60-ton overhead crane with which the transformers may be taken apart for inspection or repairs.

A building housing the 11,000-volt oil circuit-breakers and bus structure was constructed adjacent to the main transformers. This 11,000-volt switching is required for the operation of the synchronous condensers from the main transformers. The 11,000-volt switching was placed at the transformers rather than near the condensers to shorten the very heavy conductors required between the transformers and the switches. Connections from the 11,000-volt switch house and the condensers is made with underground cables.

Eight sections were added to the double 110,000-volt bus to provide for the main transformers, for looping in the two Sierra lines and for a bus tie oil circuit-breaker. The 110,000-volt bus structure of the entire station contains 27 oil circuit-breakers. It is 1350 feet in length and is believed to be the



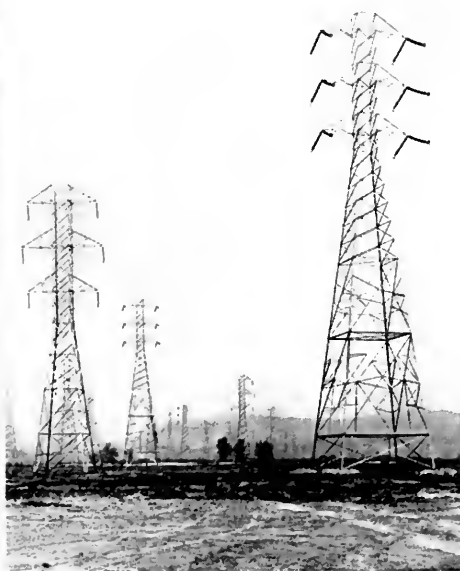
220-k.v. oil circuit-breaker tower.

most extensive structure of its kind. The buses are divided in the center by an oil circuit-breaker in one bus, and by a 110,000-volt bus reactor protected by two oil circuit-breakers in the other bus. These devices constitute the only connections between the two units of the station.

Two 25,000-kv-a. synchronous condensers were required to regulate the voltage of the two 208.5-mile, 220,000-volt circuits from Tiger Creek and an additional switchboard was required for the new equipment. An extension to the building was planned to house the new equipment. An extension of the main bay 100 feet in length provides space for the new synchronous condensers and permits the traveling crane to serve the new condensers as well as the two original 12,500-kv-a. condensers.

A bay 31 feet wide and 84 feet long was added to provide for the switchboards of the station and auxiliaries, such as water pumps, battery chargers, storage batteries and telephone terminals.

The new 25,000-kv-a., 11,500-volt synchronous condensers are equipped with a closed system of air circulation and air coolers. This arrangement keeps the condensers clean, since dust is excluded. They are also equipped with high-speed excitation systems. Direct-connected main and sub-excitors are provided, together with quick-acting voltage



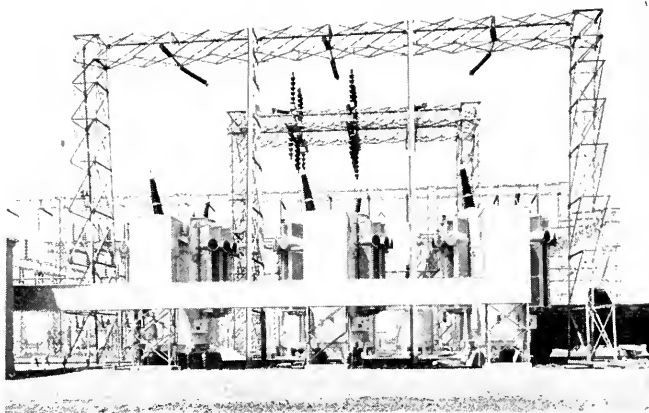
Terminal line tower, 220-k.v. Tiger Creek lines.

regulators interposed between the sub-exciter and the field circuits of the main exciters.

One of the synchronous condensers is equipped with a synchronous driving motor of 1200 horsepower which permits its use as a generator for testing the lines radiating from the station. In the event a line has given trouble and has been automatically disconnected from the system, it is much better to test the line by building up voltage on it slowly than to immediately impress full voltage upon it from the bus. The motor-driven condenser may also be used to test the automatic relays on the radiating lines.

The switchboards controlling the station were specially designed for compactness and convenience. They control 21 high-voltage lines, 6 transformer banks, 4 synchronous condensers, 5 bus tie switches and a bus reactor, together with their several auxiliaries. Provision is made for manual operation and for the automatic relay protection of each circuit. Directly in front of the operator stands a bench board on which are mounted the devices which afford manual control of the lines, transformers and condensers. The vertical panels supporting the electric meters stand behind the bench. Each line, transformer bank and synchronous condenser is equipped with a set of instruments which shows the amount and direction of the flow of power in the circuit. Behind the instrument board stands a vertical board supporting the automatic relays which protect each circuit from damage by overload or short circuit.

Newark acts as a dispatching center for the electric system in the area reached by its radiating lines. This work is done under the supervision of the Load Dispatcher in Oakland. An extensive system of telephone lines terminates in telephone switchboards on the attendants' desks in the switchboard room. Usually one of the attendants devotes his attention primarily to dispatching and the other to operating the station. In times of emergency either may help the other. The extent of the dispatching required from this



Transformer bank No. 7, 220/110/11 k.v.

station can be realized when it is known that the operation of over one thousand oil circuit-breakers and air break disconnecting switches is supervised.

One of the most interesting features of the communication plant is the carrier current telephone which makes possible the transmission of telephone messages over the high-voltage power circuits. Carrier equipments have been installed at Newark, 50th Avenue substation in Oakland, Tiger Creek power house and San Joaquin steam plant and substation at Herndon, twelve miles north of Fresno. These equipments provide excellent telephone communication between the points mentioned, also to the Load Dispatcher in Oakland through a wire extension from 50th Avenue, and to the Load Dispatcher of the San Joaquin Light and Power Corporation in Fresno through a wire extension from Herndon. The Newark carrier current telephone operates on a different frequency than the Claremont-Vaca-Pit carrier. Simultaneous use of both systems is thus made possible.

Seven cottages were added to the original eight at Newark substation to provide quarters for the enlarged staff of attendants. Extensive improvements were made to the water supply system. Two deep wells were drilled and a supply of excellent water was secured.

The construction of the new unit occupied the greater part of two years. The work was carried out by the General Construction Department from plans prepared by the Engineering Department.

# *Pacific and Great Western Systems Interconnected at Claremont Sub*

*By B. D. DEXTER, Department of Engineering*

An important step in the co-ordination of the electric properties of the Great Western Power Company with those of the Pacific Gas and Electric Company has been completed. A major interconnection between the high voltage electric transmission systems of the two companies has been established at Claremont Substation in Oakland.

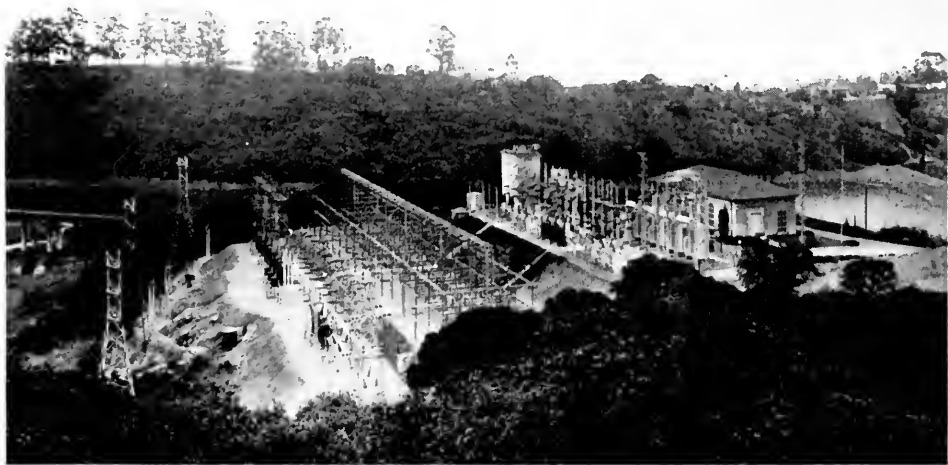
A suitable interconnection between two electric systems operating in the same territory makes possible better service on each system and several important economies. Full advantage may be taken of the possibilities of the hydro-electric plants. During periods of heavy run-off, stream-flow plants may be used to their full capacity and a maximum amount of water stored in the reservoirs for use during the dry season. The use of the most economical steam plants on either system is made possible. Spare generating capacity is made available for both systems. The diversity of the loads of the two systems is sufficient to permit some reduction in the total installed generating capacity with no sacrifice of reliability.

The establishment of a major interconnec-

tion between electric systems of such large size is not a simple matter. The equipment must be of sufficient capacity to exchange the power required to hold the systems in synchronism as well as to permit the exchange of power for most economical and reliable operation. Points on each system capable of delivering and receiving the expected exchange of power must be selected, a connecting transmission line must be built and transformers must be installed should the voltages of the two systems be different.

Claremont Substation was selected as the most suitable point on the high voltage system of the Pacific Gas and Electric Company for one terminal of the interconnection, which was a natural result of our company's acquisition of the Great Western Power properties.

With one double-circuit 110,000-volt steel tower line from Vaca-Dixon Substation on the north and a second similar tower line from Newark Substation on the south, Claremont may receive power from either or both of these main distributing centers. Claremont is also connected with the 11,000-volt net-

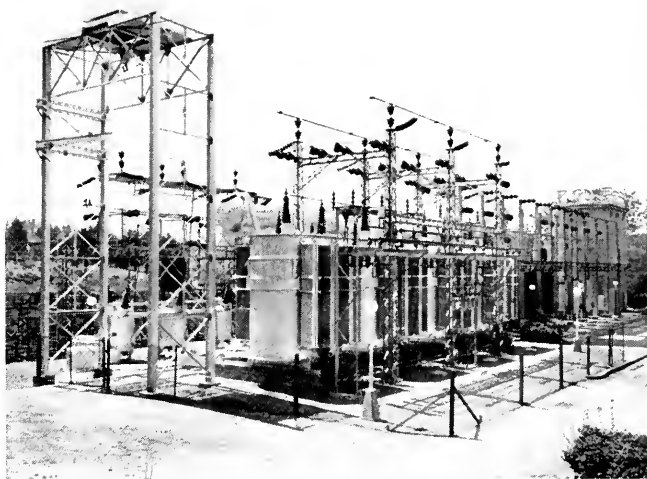


Claremont substation, on the shore of Lake Temescal, Oakland.

work in Oakland which gives it an outlet for hydro-electric power when available and permits it to receive steam electric power from Station "C," in Oakland, when necessary. Usually Claremont carries part of the Oakland and Berkeley load. It is thus in an excellent position to deliver or receive power. The voltage on its high voltage bus is 110,000 volts.

The point on the Great Western system best meeting the requirements was found at Orinda, four and a half miles east of Claremont, on the 95,000-volt transmission line which connects Golden Gate and Oakland substations. These two substations receive power from the Feather River group of hydro-electric plants over two steel-tower lines and are connected to the Great Western steam plants in San Francisco by five submarine cables.

Fortunately a spare right of way, parallel with the Vaca-Dixon-Claremont tower line,



90,000-kv-a. transformer bank No. 3, at Claremont.

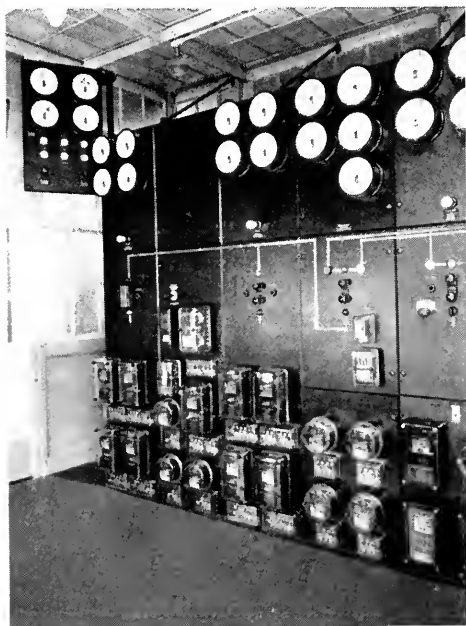
was available between Claremont and Orinda. A double-circuit tower line has been constructed on this right of way and connections made to both of the Great Western circuits.

At Claremont Substation, a bank of auto transformers of 90,000-kv-a. capacity, 110,000 to 95,000 volts, has been installed to permit the interconnection of the two systems. Three 115,000-volt oil circuit breakers have been installed to control the new transformers and the two interconnecting lines.

When the two voltages to be connected are nearly the same, the use of the auto transformer, a single winding transformer with a tap for the lower voltage is a great economy made possible by the grounded neutral system of transmission pioneered by the Pacific Gas and Electric Company. The new bank of transformers at Claremont would have a rating of 20,000 kv-a. when connected in the usual manner. This capacity is increased to 90,000 kv-a. by the auto transformer connection, and the efficiency is correspondingly increased. The new transformers have the distinction of having the greatest capacity of any bank thus far installed by the Company.

The transformers are air-cooled. Up to two-thirds' load the radiators will dissipate the heat arising from the energy losses. For higher loads the cooling is assisted by fans which blow air on the radiators.

The new transformers are larger and heavier than could be cared for by the handling



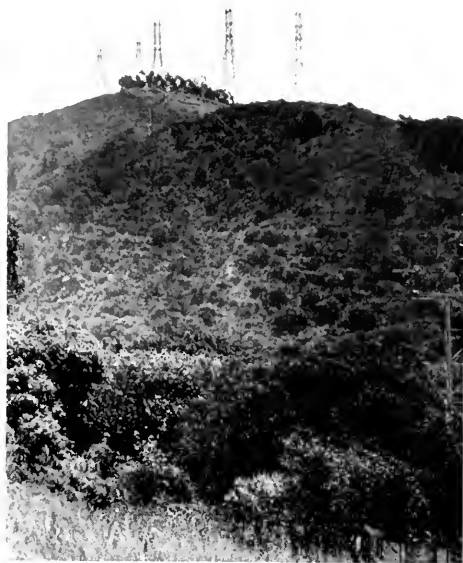
New switchboard panels at Claremont, for control of transformer bank No. 3.

facilities previously erected. A new hoist had to be built. Transporting the transformers from the railway siding that the lower end of the property over the short but steep road to the station was accomplished with house-moving equipment.

An addition to the switchboard of four panels was made for the instruments and relays controlling the new equipment. The usual meters were installed to indicate the amount and direction of flow of power through the transformers as well as in each interconnecting line. The large amount of power to be handled in either direction, and the connection of three stations, Claremont, Golden Gate and Oakland, to the double-circuit tie line, made difficult the selection of relays for automatically disconnecting the lines in the event of any failure. The relays installed provide for balanced protection when both interconnecting circuits are in service and single circuit protection when only one is in service.

The work was planned by the Engineering Department. The station work was done by the General Construction Department and the tower line was built by the Line Construction Department.

The work was completed and placed in service March 20, 1931. The interconnection has proven of great value. The utmost use

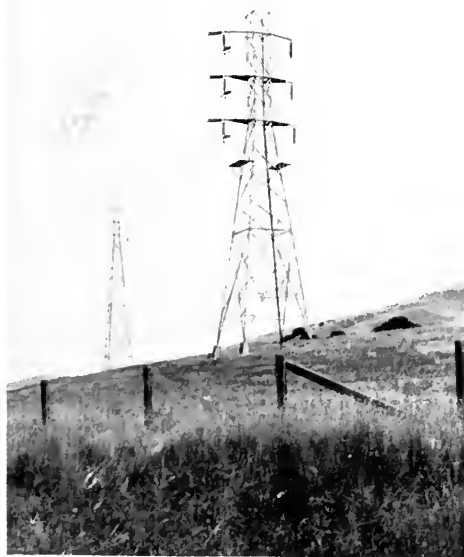


100-k.v. lines crossing the hill behind Claremont.

of the hydro-electric resources of both companies has been made possible. Loads as high as 88,000 kilowatts have been carried. A delivery of 1,000,000 kilowatt-hours per day from the Pacific to the Great Western system has not been uncommon during the past few months.

Claremont Substation was first put into commission in October, 1922. It was established to take care of the electric energy coming in from the company's newly constructed power plants on the Pit River by way of Vaca-Dixon, Cordelia and the Straits of Carquinez, and to distribute the product over the network of wires serving Oakland, Alameda, Berkeley and the surrounding territory.

The station has a marvelously picturesque setting. It stands upon an eminence overlooking Lake Temescal in the foothills back of Oakland. It was at the time of construction the last word in modern electrical equipment, with bus structures, oil switches and transformers in full view out-of-doors. It has rendered yeoman service to our company's electric transmission system in the East Bay territory and has now grown in importance because of its added responsibilities. Its transformer capacity, as reconstructed, is rated at 160,000 horsepower.



P. G. & E. and Great Western systems connected at Orinda Junction.

# Enlarging Water Conduits on Our South Yuba-Bear River System

By H. W. HABERKORN, *General Construction Department*

On our company's South Yuba-Bear River system, extending from the Sierra Nevada summit to the orchard country east of Sacramento, the recent enlargement of Bear River and Wise canals marks another step in the development of the water resources of that region to the mutual benefit of irrigation and hydro-electric interests.

These canals, diverting water from the Bear River near Colfax, supply water for the operation of power plants on the system and, also, for irrigation purposes over a large area of orchard country. Development of the system dates from 1913, with the construction of the Spaulding dam located on the south fork of the Yuba River in the high Sierras below Emigrant Gap, at an elevation of over 5000 feet above sea level, and Drum power-house in a gorge of the Bear River 9 miles below Spaulding and supplied with water from the lake by tunnel and open ditch. At intervals during the seven years that followed the development was expanded by the raising of Spaulding dam and the con-

struction of Spaulding power-houses Nos. 1 and 2, immediately below the dam, and Halsey and Wise power plants, the former located near Clipper Gap and the latter in the ravine between Auburn and Newcastle.

Lake Spaulding forms the major storage unit of the system. Besides storing 74,500 acre-feet of water from the upper drainage area of the south fork of the Yuba River, it is used to regulate the flow of an equal quantity of water stored in a chain of lakes located at elevations ranging from 5000 to 7750 feet above sea level within the 134 square miles of catchment area. These lakes, like many of the company's ditches, had their origin in the early days of California's history, at which time they were constructed and operated by companies engaged in furnishing water for placer mining uses. While some of these lakes have been reconstructed and enlarged, the majority still exist essentially in their original form, each contributing its quota to the 150,000 acre-feet total storage capacity of the system.



Bear River Canal diversion works, near Colfax.

From Lake Spaulding the water leaves by two routes. The greater portion is passed through Spaulding No. 1 power plant to the Drum conduit, thence conveyed by tunnel and ditch a distance of 9 miles to Drum power-house, after which it is allowed to flow down Bear River to the head dam of the Bear River canal fifteen miles below, where it is again diverted and passed in succession through Halsey power-house, Wise canal and Wise power-house, and is then available for domestic, industrial and irrigation uses. The balance of the water after passing through Spaulding No. 2 power-house flows via the South Yuba canal, originally a mining conduit, to Deer Creek power-house, located near Nevada City, after which it is available for irrigation and other uses in that district.

In 1924 the Nevada Irrigation District was in the process of organization. This district comprises a gross area of 268,500 acres of



New radial gate at diversion works.

land situated in the Sierra Nevada foothills between the south fork of the Yuba River and Bear River in Nevada County, and between Auburn ravine and Bear River, west of Auburn and east of Lincoln and Sheridan, in Placer County. The towns of Nevada City and Grass Valley are located within the general boundaries of the district but are not a part thereof. The principal sources of its water supply are a number of reservoirs located on the upper middle and south forks of the Yuba River, purchased by the district, having a combined capacity of approximately 108,000 acre-feet. Bowman Reservoir is the largest of the group.

In 1926 an agreement was entered into between the district and the Pacific Gas and Electric Company whereby the former engaged to construct a conduit between its reservoirs and a point 330 feet in elevation above Lake Spaulding, the Pacific Gas and Electric Company on its part agreeing to construct a power-plant, now known as Spaulding No. 3, on the north rim of Lake Spaulding.



Concrete flume on the canal near its intake.

ding, through which all of the district's mountain water would pass. In addition, the company enlarged the capacities of Spaulding plants Nos. 1 and 2, also of the Drum conduit and Drum power-house, to enable them to utilize the additional 108,000 acre-feet of water to be received annually from the district under the agreement. The money paid the district by the company for the use of this water for the generation of electrical energy in its power-plants has been used by the district to help defray the cost of its capital investment. The district also purchased from the company its irrigation distribution ditches below Deer Creek power-house, so that all of the water delivered by the South Yuba flumes to Deer Creek becomes the property of the district immediately below that plant.

By 1929 the mountain projects of the irrigation district, and some of the valley dams, had been largely completed. However, much remained to be done in the way of laterals and main canals leading from these dams and supplying the portion of the district located in Placer County. For that reason a second agreement was entered into with the company under the terms of which the latter contracted to enlarge its Bear River and Wise canals to a capacity sufficient to carry 120 second-feet of the district's water along with its own, pass it through its Halsey and Wise power-houses and deliver it at points along the canal from which the Nevada Irrigation District would receive the water for distribution to its lands.

Bear River canal is 23 miles in length and the section of Wise canal requiring enlarging 3 miles in length, making in all 26 miles of conduit enlarged. This includes three tunnels on each of the canals, totaling nearly two miles in length, and over three-quarters of a mile of reinforced concrete and metal flumes.

The capacity of the Bear River canal was increased from 350 to 475 cubic feet per second and that of Wise canal from 325 to 450 second-feet. The method of increasing the capacity of these conduits consisted essentially of raising the water surface and increasing the velocity of flow. This last was accomplished by lining the outer slopes of



Reinforced concrete flume around cliffs.

the canals, thereby decreasing the friction and speeding up the flow, and by extending the lining to the proper height to provide for the increased depth of flow. Existing timber flumes were replaced with flumes of greater capacity constructed of reinforced concrete or metal, and the tunnels were enlarged by excavating and lowering the bottom several feet.

The material chosen for the lining of the canal slopes was a Portland cement and sand product known by the name of gunite. It is applied by forcing a mixture of sand and cement under pneumatic pressure through a rubber hose to a nozzle, at which point the proper amount of water is introduced, and thence to the surface to be coated. This results in a very dense product of high strength which due to the ease of application lends itself admirably to the lining of irregular ditches. It may be built up to any desired thickness. In this instance a minimum thickness of one and one-half inches was used, being increased to two inches and over in those sections of the canal where the porous condition of the ground made it desirable to

continue the lining across the bottom and uphill slope. Where the existing berm would not provide sufficient freeboard for the new depth of flow the gunite lining was extended the required distance. Along sections of the canal where it was necessary to raise the existing berm more than one foot, a vertical L wall was constructed of reinforced gunite on top of the berm, the front of the wall being joined to the lining so as to form one continuous surface. Walls as high as 3 ft. 6 in. were constructed in this manner. To minimize cracks due to shrinkage and to give added strength the lining was reinforced throughout with a galvanized welded wire fabric. Over 2,000,000 square feet of this type of lining was placed along the walls of the canals, requiring nearly 100 carloads of cement, 400 carloads of sand and 17 carloads of wire mesh reinforcing.

The entire outer slope was carefully trimmed to present a smooth surface and a narrow trench 12 inches deep was excavated along the toe of the slope. At those sections of the canal where a lining along the bottom and both sides was deemed necessary, the



Gunite lining on canal, showing 2-inch cantilever wall, 3 feet in height.

entire area to be lined was trimmed. The area so prepared was next covered with a mat of wire mesh consisting of galvanized wires welded together at 3- and 4-inch intervals in both directions.

The gunite was then applied by means of cement guns, compressed air being supplied from portable gas engine driven compressors. As many as four gunite crews operating at the same time were used in placing the lining, each crew covering from 2000 to 3000 square feet of surface per shift.



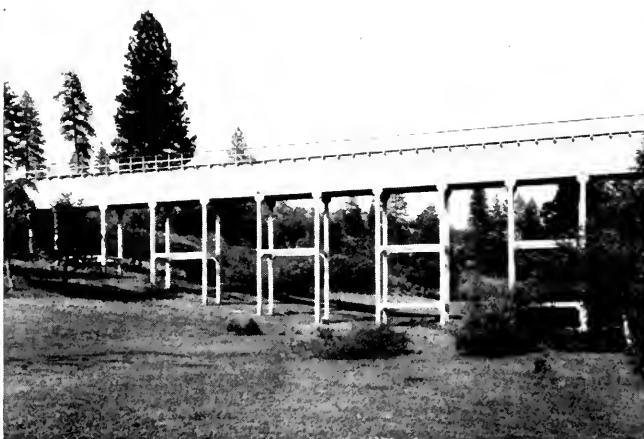
Metal flume over shifting ground near Applegate.

Dependence on this canal by irrigation users in the valley made it necessary to limit the construction work to the 6 or 7 months between the irrigation seasons. This also made it desirable to spread the work over two seasons. To enable the guniting to be started promptly the first season, sand and cement were distributed along the first 6 miles of the Bear River canal while the canal was still in service by means of open steel tubs, 6 ft. in diameter and  $3\frac{1}{2}$  ft. deep.

Sand and cement in sacks were loaded into these tubs at the road cross-

ings and allowed to float down the canal to stock piles located at frequent intervals along the berm and uphill bank of the canal. The empty tubs were then allowed to continue on their way to a road crossing 6 miles distant, at which point they were hoisted out of the water, loaded a dozen at a time on trucks and hauled back to the loading point ready for a repetition of the entire procedure.

The berm of Bear River canal is too narrow to allow its being used by trucks for hauling sand and cement for the guniting operations. In addition a considerable length of the canal is located along steep hillside quite inaccessible from roads. It was therefore necessary along these sections to set up sand storage bins and cement warehouses wherever a road crosses the canal. The sand was sacked and, together with the cement and wire mesh reinforcing, was loaded on small trailers mounted on caterpillar treads which were drawn along the bottom of the ditch by 30-ton caterpillar tractors, and delivered directly to the cement guns as required.



High concrete flume, 370 feet long, cuts off a half-mile of ditch—near Applegate.

Along other sections of the canal where flatter topography permitted the construction of secondary roads, cement and sand were mixed at central points and hauled over these roads in 1½-ton dump body trucks and delivered along the banks of the canal to the cement guns directly as required.

With the exception of two short concrete flumes, all existing flumes at the time the enlargement was started were of wood. These were replaced with 763 ft. of metal and 3014 ft. of reinforced concrete flumes. At one point on the Bear River canal the lining and

maintenance of 1½ miles of canal and the replacement of two wood flumes with concrete structures was avoided by constructing a reinforced concrete flume 360 ft. long on high concrete bents across a narrow draw. The reinforced concrete flumes are 10 and 12 ft. wide inside, with walls 7 ft. 9 in. high and tapering from 8 in. thick at the base to 5 in. at the top. They are supported by bearing walls constructed



Outlet to Ragsdale tunnel, near Halsey forebay.

along each side of the flume. Where pulleys and washes were encountered these were replaced with reinforced concrete beams supported by concrete posts constructed on solid foundations at 16 ft. intervals. The concrete for many of these dunes was mixed at plants set up on



Applegate flume in section near Newmarket.  
50-ft. span over rocky road.

the mountain side several hundred feet above the flume and conveyed to them through wooden, metal-lined chutes.

At two points where unstable ground was encountered, the old wood dunes were replaced with semi-circular metal dunes supported on timber substructures. This type of construction being less rigid than concrete lends itself to locations where settlement of the foundations is likely to occur.

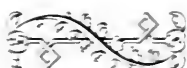
The smaller of these dunes is 14 ft. 2 in. wide. The larger, 15 ft. 6 in. wide, was constructed at a point located near the middle of Bear River canal where the hillside has been moving for many years. This section was formerly crossed by a winding timber flume from which it was difficult to eliminate leakage due to the moving ground. A straight metal flume, 300 ft. long, supported on timber bents and cross-ties sills, now replaces it. The straight alignment will make it possible to detect even a slight movement of the foundations and the design of the supports is such that the structure may readily be jacked back into position.

To increase the capacity of the existing tunnels, 3 ft. high by 3 ft. 6 in. wide in the unlined sections and approximately 7 ft. 6 in. high by 5 ft. wide in the lined sections, the floor was lowered  $1\frac{1}{2}$  to  $3\frac{1}{2}$  feet. Trucks and small dump cars hauled by gasoline locomotives were used to remove the excavated material. An average of from 15 to 30 ft. of tunnel was excavated per 24 hours depending upon the depth to be removed.

Approximately one third of the total length of the tunnels was originally lined with concrete. In these sections the walls were extended and a new floor poured. In general all old wood linings were replaced with reinforced concrete and in sections of the tunnel running through sandy rock the walls and roof were sealed with grout in an effort to reduce leakage to a minimum.

The enlarging of these tunnels involved working in very crowded quarters, the clear opening at some sections being only a few inches wider than the gasoline locomotives used for the hauling of excavated and other materials. In spite of the increased hazards due to this condition, the work was turned out on schedule without a single serious accident.

The Nevada Irrigation District, in common with the experience of many other districts, found that in order to make its venture sound economically it was necessary that the water be first put to work to develop electrical energy before being released for irrigating the soil. In some instances irrigation districts have attempted to develop and market the power themselves, however, irrigation men are seldom sufficiently versed in power development any more than those in the power business are familiar with all the irrigation problems. Therefore, it has generally been found that the best solution lies in joint agreements such as that now in force between the district mentioned and the P. G. & E. Co.



## The Financial Side of "Pacific Service"

Following is a statement of the Company's consolidated income account for the six months ended June 30, 1931, compared with the same period of 1930. For the purposes of comparison, the operations of all companies now in the consolidated system were included for both periods covered by this statement.

### CONSOLIDATED INCOME ACCOUNT

	6 MOS. TO JUNE 30, 1931	COMPARISON WITH FIRST HALF OF 1930 Increase or *Decrease
Gross Revenue, including Miscellaneous Income.....	\$43,707,243	\$466,515
Maintenance, Operating Expenses, Taxes (including Federal Taxes), and Reserves for Casualties and Uncollectible Accounts.....	18,765,696	190,980*
Net Income.....	\$24,941,547	\$657,495
Bond Interest and Discount.....	7,566,324	149,775
Balance.....	\$17,375,223	\$507,720
Reserve for Depreciation.....	5,418,837	282,492
Balance.....	\$11,956,386	\$225,228
Dividends Accrued on Preferred Stock.....	3,971,217	184,301
Balance.....	\$ 7,985,169	\$ 40,927
Dividends Accrued on Common Stock.....	5,975,817	331,877
Balance.....	\$ 2,009,352	\$290,950*

The balance of \$7,985,169 available for dividends on the Company's common stock was equivalent to \$1.34 per share upon the average of 5,975,817 shares of common outstanding during the first half of 1931. This compares with earnings of \$1.41 per share upon an average of 5,643,940 common shares outstanding in the six months ended June 30, 1930, assuming that the common stock issued in exchange for the California subsidiaries of The North American Company, which were acquired on June 9, 1930, had been outstanding for the full semi-annual period.

Unfavorable conditions affecting the business in the first six months of 1931 were (1) depressed business conditions, which retarded normal growth and more specifically diminished power sales; (2) deficiency of rainfall, which has increased operating expenses; (3) rate reductions on the San Joaquin Valley system; (4) comparisons in the gas department still being made against a considerable proportion of manufactured gas last year; and (5) larger amount of capital employed, our plants and properties account since July 1st, 1930, having increased by about thirty-five million dollars.

Favorable conditions were (1) increased agricultural usage of electric energy, and larger deliveries to other utilities which have also been affected by the deficient precipitation; (2) continued growth in the volume of electric sales to domestic consumers, resulting from active sales efforts; (3) operation of our steam plants with natural gas; and (4) increasing industrial usage of natural gas.

Sales of electric energy on the entire system were 1,593,337,678 k.w. hr., a gain of 30,077,829 k.w. hr., or 1.92%. Approximately 250,000 horsepower of additional installed electric generating capacity recently completed on the Mokelumne River and in our San Francisco steam plants has enabled us to meet all demands on our own system and those of other utilities dependent upon us for electric energy.

### BOND REFUNDING OPERATIONS

Arrangements have been made to call for redemption the entire outstanding issues of \$707,000 par value of California Telephone and Light Company First Mortgage 6% Bonds, due April 1, 1943, and \$1,473,500 of Consolidated Electric Company General Mortgage 5% Bonds, due June 1, 1955. The former will be retired at 107½ on October 1, 1931, and the latter at par on December 1, 1931.

The calling of these issues marks the completion of a bond refunding operation begun by the Pacific Gas and Electric Company in the latter part of 1930 and continued during the current year. As a result of this refinancing, sixteen bond issues of the Company and its subsidiaries have been retired at maturity or called for prior redemption, considerably simplifying the Company's financial structure and permitting of substantial savings in annual fixed charges. Following is a list of the issues which have been or will be retired from November, 1930, up to the close of 1931, the necessary cash having been obtained through the sale of the Company's First and Refunding Mortgage Series "F," 4½% Bonds, due June 1, 1960:

DATE OF MATURITY OR CALL	NAME OF ISSUE	PAR VALUE
November 2, 1930	Great Western Power Co. of California Five Year, 5½% Gold Notes .....	\$ 4,000,000
December 1, 1930	Great Western Power Co. of California First & Refunding Series "A" 6% Bonds .....	5,681,900
January 1, 1931	Feather River Power Co. 1st Mtg. 6% Bonds.....	5,308,000
January 1, 1931	Modesto Gas. Co. 1st Mtg. 6% Bonds.....	152,000
January 1, 1931	Napa Valley Electric Co. 1st Mtg. 6% Bonds.....	34,000
April 1, 1931	Great Western Power Co. of California First & Refunding Series "D" 5½% Bonds .....	9,087,000
April 1, 1931	Bay Counties Power Co. 2nd Mtg. 6% Bonds.....	182,000
April 1, 1931	Yuba River Power Co. 1st Mtg. 6% Bonds.....	964,000
April 15, 1931	Consumers Light & Power Co. General Mtg. 6% Bonds.....	58,000
June 1, 1931	Keswick Electric Power Co. 1st Mtg. 5% Bonds.....	13,000
July 1, 1931	Tracy Gas Co. 1st Mtg. 6% Bonds.....	84,500
July 1, 1931	Sierra & San Francisco Power Co. 2nd Mtg. Series "A" 6% Bonds....	1,000,000
August 1, 1931	Great Western Power Co. of California 1st & Refunding Series "C" 6% Bonds .....	5,660,400
August 1, 1931	California Central Gas & Electric Co. 5% Bonds.....	284,000
October 1, 1931	California Telephone & Light Co. 1st Mtg. 6% Bonds.....	707,000
December 1, 1931	Consolidated Electric Co. General Mtg. 5% Bonds.....	1,473,500
TOTAL.....		\$34,689,300

Of the bonds retired, eleven issues, aggregating \$19,831,800 par value of bonds bore a 6% coupon rate, two issues, aggregating \$13,087,000, bore a 5½% coupon rate, and three issues, aggregating \$1,770,500, carried a 5% rate.

# Pacific Service Magazine

PUBLISHED QUARTERLY IN THE INTERESTS OF  
PACIFIC GAS AND ELECTRIC COMPANY

FREDERICK S. MYRTLE - EDITOR-IN-CHIEF

PACIFIC GAS AND ELECTRIC COMPANY  
245 Market St., San Francisco

*The Pacific Gas and Electric Company desires to serve its patrons in the best possible manner. Any consumer not satisfied with his service will confer a favor upon the management by taking the matter up with the division headquarters.*

VOL. XVIII JULY, 1931 No. 5

An interesting feature of the opening ceremonies at the Mokelumne River development July 12th was an address by our company's president, Mr. A. F. Hockenbeamer, in which the status of "Pacific Service" in relation to ownership and control as well as operation was set forth in very clear terms.

The Pacific Gas and Electric Company has, during recent years, materially increased its gas and electric service resources through the acquisition of important utilities operating in sections of northern and central California either within or contiguous to the "Pacific Service" territory at the time. These transactions have resulted in rounding out, so to speak, and, in some instances, extending the "Pacific Service" territory; the company's position in regard to service facilities has been considerably strengthened thereby and many thousand names have been added to the list of "Pacific Service" consumers.

The acquisitions referred to have been, in most cases, effected by exchanges of stock between the parties concerned.

The most important transaction of the kind in the company's history was entered into last year, in an agreement to purchase from the North American Company, of New York, its controlling interest in three California utilities, including the Great Western Power Company, the San Joaquin Light and Power Corporation and the Midland Counties Public Service Corporation, with their subsidiaries. This agreement has since been consummated, our company paying for the properties 1,825,000 shares of common stock. The North American Company's holdings, including those of its subsidiary, the Western Power Corporation, have since been increased to 2,008,729 shares of P. G. and E.

stock as of June 30th this year. On the same date there were outstanding 10,812,000 shares of Pacific Gas and Electric Company stock, all of which, common and preferred, under the California law as well as the company's charter have voting rights; the Eastern concern, therefore, appears as the holder of 18.58 per cent of our company's total stock issue to date. The merger of the Great Western Power Company's properties with "Pacific Service" is now approaching its final stages and our company also has in contemplation an offer to the San Joaquin Light and Power Corporation's preferred stockholders to exchange their stock for Pacific Gas and Electric Company stock. This, if carried out, will involve the issuance of additional shares by our company, and when this increase of its stock total comes to be made it will have the effect of reducing the North American Company's holding to 17½ per cent of the whole outstanding.

It will be seen, then, that while, through the transaction referred to, the North American Company appears on our company's books as the largest individual stockholder, its interest is very far from being a controlling one. Although a recent amendment to the California corporation law permits the issuance of non-voting stock, our company's management announces the definite and continuing policy of maintaining all classes of its stock as voting stock; so that, for purposes of control estimate, all classes of stock must be taken into consideration. At this time of writing, the aggregate market value of the outstanding stocks of the Pacific Gas and Electric Company is about \$425,000,000, without counting \$25,000,000 of unexchanged stocks of subsidiaries. Without making allowance for the higher market levels that would follow any concerted buying, it is obvious from these figures that the purchase of even 1 per cent of the total outstanding P. G. & E. stock issue would represent an investment of at least \$4,250,000; and the purchase of a sufficient percentage to secure control of the company would involve an investment of such magnitude as to be practically impossible in view of the wide distribution of the stock and the difficulty of getting hold of any considerable quantity in the open market.

As a matter of fact, the reverse is the situation resulting from the transaction with the North American Company. Our company's purchase of the Great Western Power Com-

pany, San Joaquin Light and Power Corporation and Midland Counties Public Service Corporation has had the effect of removing three important California utilities from Eastern control and returning them to California, where they belong and where they are likely to stay. Similar has been the result of previous purchases by our company of utilities controlled by Eastern interests. Prominent among these may be mentioned the Sierra and San Francisco Power Company, Western States Gas and Electric Company and Coast Valleys Gas and Electric Company. The Pacific Gas and Electric Company remains California owned and controlled as well as operated. To quote Mr. Hockenbeamer: "Anybody wanting to do business with Pacific Gas and Electric Company, whether it be to sell a bucket of paint or to buy a \$25,000,000 bond issue, will still have to do business at 245 Market Street, San Francisco."

Upon the general subject of utility stock ownership, our company has recently compiled statistics covering the distribution of ownership of the gas and electric companies of California. These show that there are 219,687 California owners of these utilities holding \$338,285,000 par value of stock, with an aggregate present day market value of almost \$500,000,000.

The stocks of the nine major operating companies, namely, Pacific Gas, Southern California Edison, Los Angeles Gas & Electric, Southern California Gas, Southern Counties Gas, San Diego Consolidated Gas & Electric, California-Oregon Power, Coast Counties Gas & Electric and Nevada-California Electric, are owned by 236,453 investors, of whom 188,150, or four-fifths, are California residents, and 48,303 reside outside of the state. In addition, the stocks of the Pacific Lighting Corporation and Pacific Public Service Company (the former owning a controlling interest in the Los Angeles Gas & Electric and Southern California Gas and affiliated companies and the latter in the Coast Counties Gas & Electric) are held by 31,537 Californians and 2,332 others. Altogether, there are more than 270,000 partners in these various utility enterprises.

#### SETS A SPLENDID EXAMPLE

(*Sacramento Weekly Commercial News*,  
July 17th.)

The editor of *Sacramento Commercial News* was present last Sunday at the dedica-

tion of the Tiger River powerhouse, a unit of the Pacific Gas and Electric Company's Mokelumne River hydro-electric development, and listened with much satisfaction to the recital by President A. F. Hockenbeamer, during the course of his remarks, of a long list of California manufacturers who had supplied the materials and equipment for this project, which to date represents an investment of \$25,000,000, and will ultimately represent an investment of \$40,000,000.

A project of this scope necessarily requires a vast amount of construction equipment and miscellaneous materials, in addition to the materials that go into miles of concrete flume and tunnels, the great amount of steel pipe for syphons and penstocks, the machinery and equipment of powerhouses, the tons of fabricated steel for many miles of transmission lines.

Every item for this big project that could be manufactured in California was purchased here, mostly in this immediate section of the state. Copper wire and some of the generating machinery were the only things that were brought in from the outside, so that fully 85 per cent of the equipment and materials were California products. Many of the supplies were bought in the little city of Jackson, which is the closest trading point to the project.

President Hockenbeamer seemed to take great pride in the fact that his company uses home products. In all their operations they buy what they can right in the community or district where the work is being done. It is a commendable policy and one that more of our big corporations and smaller business concerns could well emulate. Every one of us should look to our own city first, then to our own area or our own state for all our requirements.

The dollar that circulates in the channels of local trade is the dollar that is most apt to come back to us in our own business operations.

Incidentally, how many of our readers realize the scope of the operations of Pacific Gas and Electric Company, the big organization that is proud of the fact that it is owned, operated and managed by Californians? Everybody everywhere regards the building of the Hoover dam on the Colorado River as a tremendous project. The work will take six and one-half years and will involve an expenditure of \$48,890,995. Pacific Gas and Electric Company, operating in central and

northern California, spent \$48,888,744 for new construction in the ONE year of 1930, and similar sums will be spent in 1931 and 1932.

### A BIG DEVELOPMENT

(Editorial in *Colusa Herald*, July 13th.)

We have just returned from the Pacific Gas and Electric excursion to the Salt Springs dam and Tiger Creek powerhouse, a wonderful project. We had the opportunity of hearing the water, stored up by a huge dam at Salt Springs, carried eighteen miles to a forebay 1200 feet above the Tiger Creek plant and then down through a penstock, rush into the turbines and start the giant generators whirling. More than 200 editors were on the trip and the project will get publicity from all over the state. It is unfortunate that it is not possible for every citizen of the state to

see the Salt Springs and Tiger Creek project, for it is a revelation as to difficulties overcome.

As to the Salt Springs-Tiger Creek trip the charge already has been made that newspapermen are being subsidized by these P. G. & E. trips. In fairness, it should be said that not a single suggestion as to editorial handling of the dam's completion was made. Not a word was said as to how the news stories should be written. The trip was for publicity's sake, however, and we don't know of any way that more publicity could be given. As a matter of fact, the fellow who stayed at home gave publicity on the project. And we can't see why such a tremendous feat as the development of water power from these little mountain streams shouldn't be given lots of notice, because it is a step in the progress of California.

### IN MEMORIAM — CHARLES H. DICKEY

Charles Herman Dickey, a member of our company's board of directors and a leading figure in the gas industry throughout the country, passed away June 17th at Del Monte, California, at the age of 71 years.

The story of Mr. Dickey's life is one of earnest application backed by keen foresight and judgment. He was born at Baltimore, Jan. 9, 1860. As a boy he attended the public schools of his native city and completed his education at Muhlenburg College, Allentown, Pa. When only 17 years of age he started upon his business career in the employ of his father, Charles E. Dickey, in the gas meter business. In 1880 Mr. Dickey sr. organized the Maryland Meter Company and in 1882 the son was taken into partnership. As time went on he was instrumental in bringing about the consolidation of several gas meter manufacturers, resulting in the formation of the present American Meter Company in 1896. He became president of the American Meter Company in 1911, retaining this position until 1923, when he resigned and was elected chairman of the board.

In the meantime Mr. Dickey had conceived the idea of establishing the Pacific Meter Works in San Francisco and Los An-

geles as a branch of the American Meter Company. Upon its organization in 1921 he took the position of manager and served in this capacity until his retirement from active business on April 20, 1927, rounding out more than 45 years in the gas meter business.

After taking up his residence in California in 1921 he became affiliated with the Pacific Lighting Corporation and the Pacific Gas and Electric Company, serving as a director of both of these companies up to the time of his death. He was also associated with Mr. F. R. Bain in the organization of the Southern Counties Gas Company, serving for many years as its vice-president.

Throughout his business career Mr. Dickey was active in the work of the American Gas Association. He was a director of the national body and during the year 1929-30 he served as president of the Pacific Coast Gas Association. He was of a kindly disposition and that quality, combined with a magnetic personality, gave him a place of leadership among men.

He is survived by his widow, Mrs. Araminta Duvall Dickey, and six children. One son, William Duvall Dickey, is manager of the Pacific Meter Works.



# PACIFIC GAS AND ELECTRIC COMPANY

A CALIFORNIA CORPORATION

Managed by Californians

Operated by Californians

THE CONSOLIDATED "PACIFIC SERVICE" SYSTEM REPRESENTS (as of June 30, 1931)

- 13,830 employed in all departments.
- \$650,000,000 capital invested in gas, electricity, street railway, steam and water plants.
- 85,000 square miles of territory in which it operates— an area greater than that of England and Wales.
- 85,000 stockholders.
- 45 counties of the State in which it transacts business.
- 1,246,600 consumers served with gas, electricity, water and steam.
- 2,750,000 people in 45 counties, which is approximately 50 per cent of the State population.
- 618 cities and towns in which it supplies service directly and through other companies.
- \$27,979,000 annual wages paid employees, year ending June 30, 1931.
- \$9,345,000 taxes, Federal, State, county and local, year ending June 30, 1931.
- 1,177,807 horsepower developed in 50 electric water-power plants.
- 510,188 horsepower developed in 15 electric steam plants.
- 1,687,995 total horsepower developed in 65 plants.
- 3,320,667,000 kw. hours sold, year ending June 30, 1931. This is equivalent to the effort of 11,069,000 men.
- 24,237,752,000 cubic feet of gas sold, year ending June 30, 1931.
- 33,397 miles of electric transmission and distribution lines. Greater than the distance around the earth.
- 6,931 miles of mains used in distributing gas. Greater than the distance between San Francisco and Oslo, Norway.
- 955 miles of mains and ditches used in distributing power.
- 1,370 miles of track of railway supplied with electric power.
- 616,395,950,000 gallons of water storage capacity of 115 lakes and reservoirs. This amount of water would supply the City of San Francisco at the present rate of consumption for approximately 34 years.
- 215,121 acres of land owned in California.
- 572 parcels of property owned in cities and towns.
- 577,284 horsepower in agricultural motors depending on "Pacific Service."
- 1,064,083 horsepower in mining, electric railways, manufacturing and other motors depending on "Pacific Service."
- 18,338,000 incandescent lamps nightly lighted.
- 3,597,026 horsepower connected to system.

PACIFIC GAS AND ELECTRIC COMPANY  
General Offices: 245 Market Street  
San Francisco

Branches in all principal cities and towns of 45 counties of North Central California.



Back of  
PACIFIC GAS AND  
ELECTRIC COMPANY  
SECURITIES

are the resources of

NORTHERN AND CENTRAL  
CALIFORNIA

The Company furnishes services of a nature essential to the agricultural, industrial and commercial development of the vast territory in which it operates.

In this rich and progressive field, 85,000 miles in extent, is a population of 2,750,000. Approximately 1,250,000 customers are connected to the Company's lines.

The Company's bonds and stocks are held by more than 120,000 investors, each of whom is receiving interest or dividends regularly.

The Company's Three Major  
Security Issues are:

FIRST AND REFUNDING MORTGAGE  
BONDS

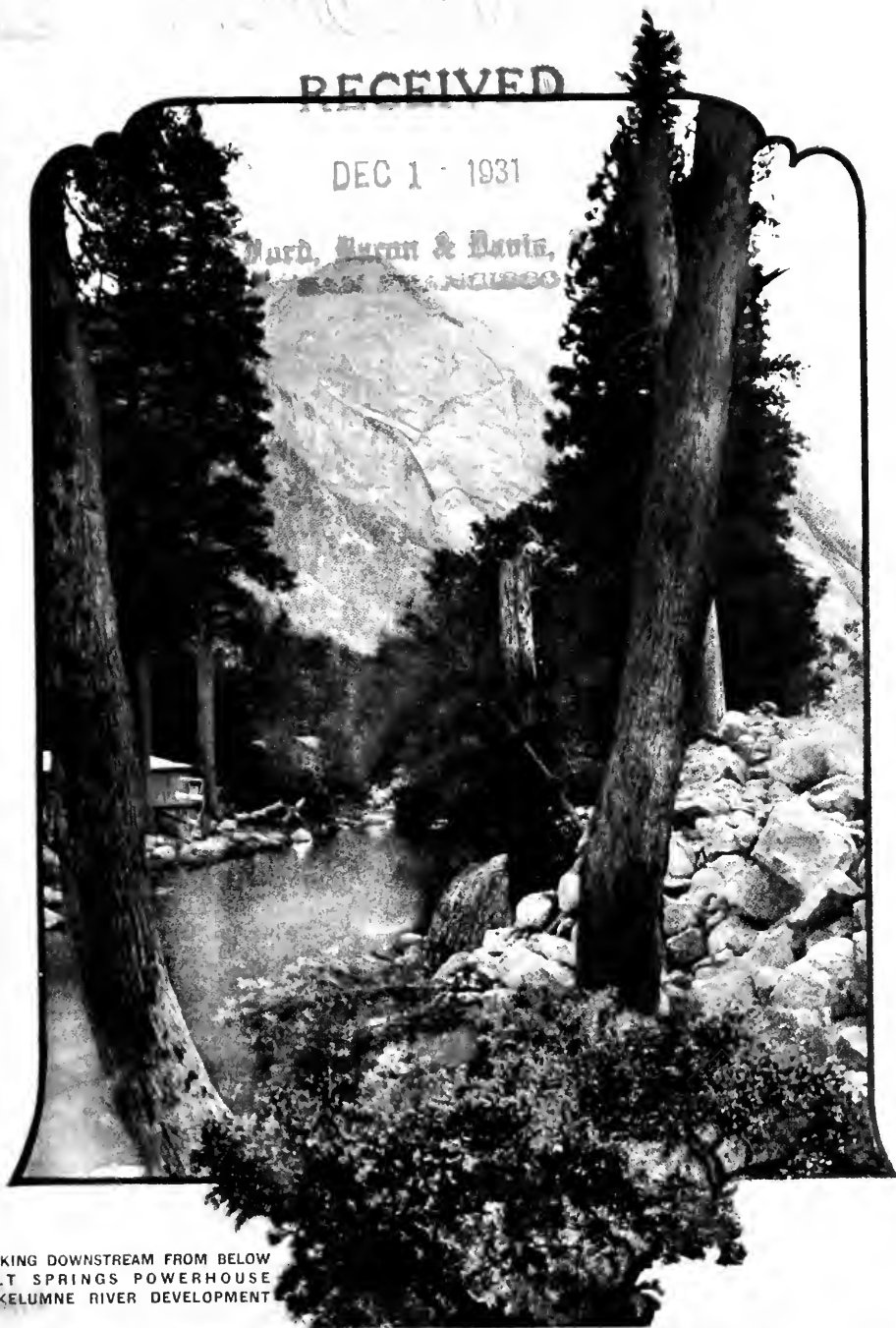
FIRST PREFERRED STOCK  
COMMON STOCK



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DEC 1 - 1931

Murd, Bacon & Davis,  
SAN FRANCISCO



LOOKING DOWNSTREAM FROM BELOW  
SALT SPRINGS POWERHOUSE  
MOKELUMNE RIVER DEVELOPMENT

Vol  
18

OCTOBER 1931

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		Red Bluff

# Pacific Service Magazine

Volume XVIII

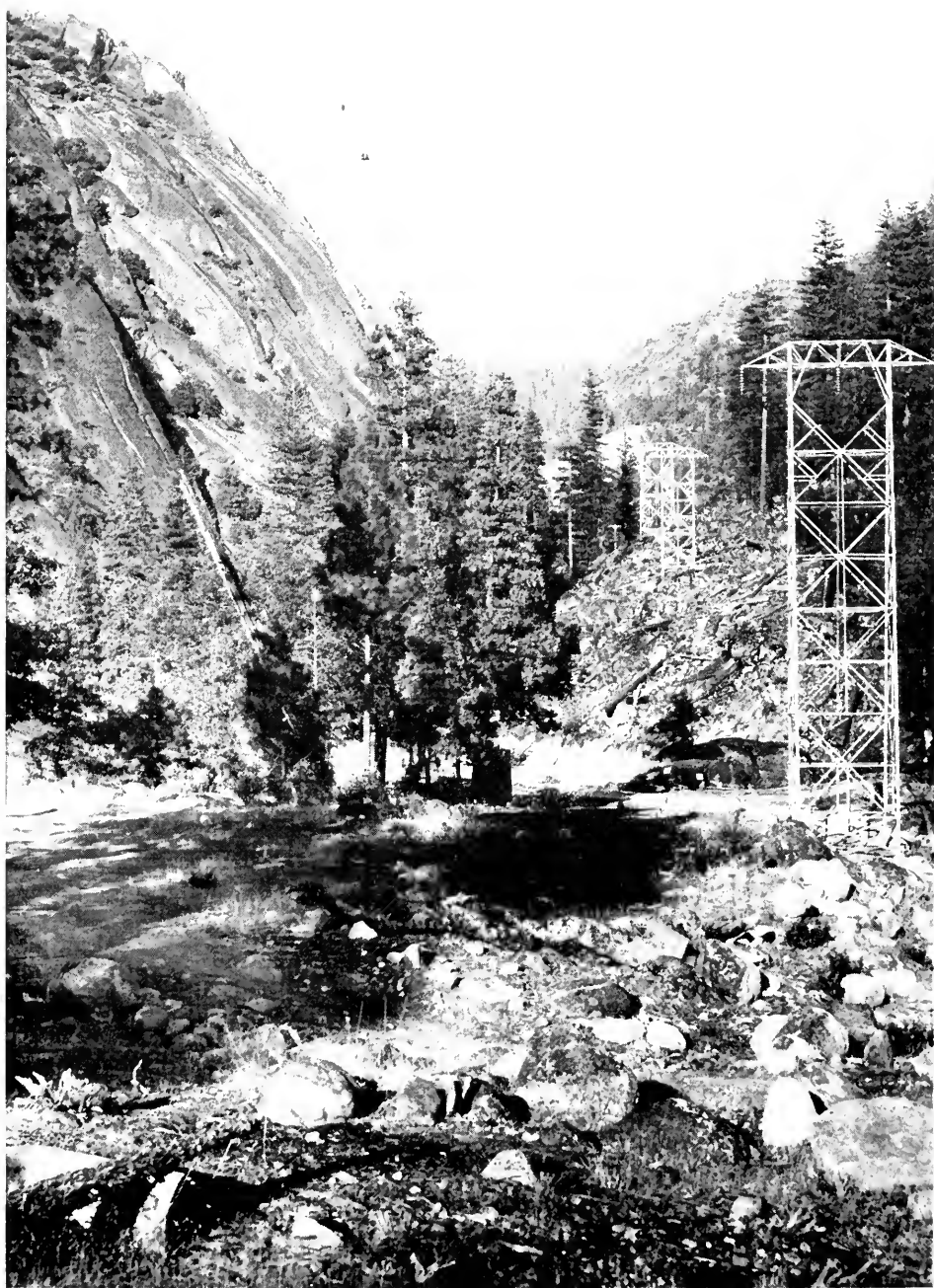
OCTOBER, 1931

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The great "Pacific Service" transmission tie-in. Salt Springs-Tiger Creek line, Mokelumne River Development, looking toward Salt Springs.

# PACIFIC SERVICE MAGAZINE

Vol. XVIII

OCTOBER, 1931

Number 6

## Station "A" Reconstruction Completed— High-Pressure Units Now in Operation

By C. E. STEINBECK, Assistant Engineer, Department of Engineering

Our company has just completed the reconstruction of Station "A," its great steam-electric generating plant in San Francisco, and has placed in operation the first two of a projected total of four high-pressure generating units under a plan described in a previous issue of PACIFIC SERVICE MAGAZINE.

As a result, Station "A" is now rated as the largest high-pressure steam-electric generating plant in the world, producing electric energy at the rate of 174,000 horsepower per hour and doing so with economy second to no plant using steam as motive power. And, when the present plan of enlargement is carried to its final stage, the station's rated generating capacity will be upwards of 340,000 horsepower.

Station "A" is located in the Potrero district of San Francisco, bordering on the western shore of the bay. It was built by the Independent Light and Power Company and was first placed in operation in 1901. Two years later the San Francisco Gas and Electric Company bought out the Independent and so acquired the station. In 1905 came the incorporation of the Pacific Gas and Electric Company through a merger of the California Gas and Electric Corporation with the San Francisco Gas and Electric Company, and ever since that time the station has been owned and operated by "Pacific Service." Today our company benefits by the good judgment of those men who selected the site and built the building which has housed one



Station "A," at the Potrero, San Francisco, as recently reconstructed



new units brings the present plant capacity to 210,000 horsepower. The old generators will be removed in the future as load growth demands the installation of more steam-generating capacity and, according to the plan referred to, will be replaced by two units similar to the two modern ones recently placed in operation.

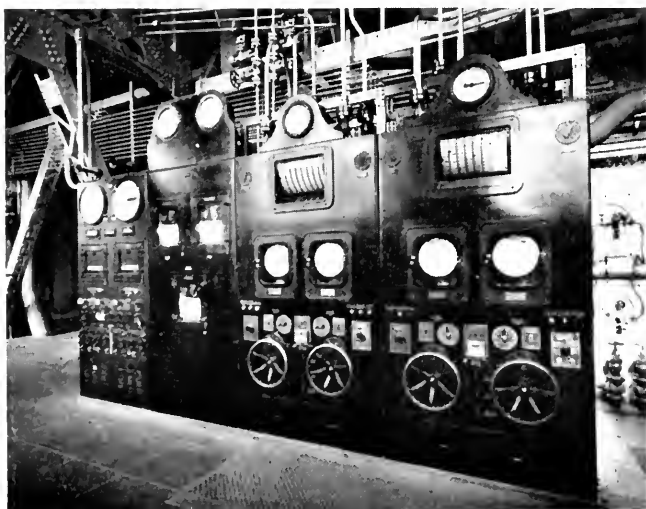
As speed has had a great deal to do with the making of all progress, it may be said that this is one reason why advancement has been made in this industry. The largest of the steam engines installed at Station "A" in the first period from 1901 to 1906 was 4,700 horsepower and ran at 106 revolutions per minute. This was about as fast as it was practical to run the generator with the engine direct connected to it, because of the large weight that had to be moved. Cast iron was the principal metal used in its construction and its strength was only about one-quarter that of cast steel, which is used at the present time. The total weight of one of the engines and generators was 1,361,000 lbs., or 290 lbs. per horsepower. The rotating parts of the electric generator weighed 173,100 lbs., or 37 lbs. per horsepower.

The advent of the steam turbine and better materials made it possible to operate at higher rotative speeds. For instance, the low-pressure element of one of the modern turbines at Station "A" operates at 1,800 revolutions per minute and weighs 720,000 lbs., or only 10.4 lbs. per horsepower. The moving parts of the electric generator weigh only



Front view of boiler No. 1.

1.45 lbs. per horsepower. Thus it is a simple matter to see that, because of the greater mass, the old type of electric generators occupied much more space and now we are able to install so much more generating capacity in the same space. The weight per horsepower is also reduced with the size of the unit; that, also, has been a space-saving factor.

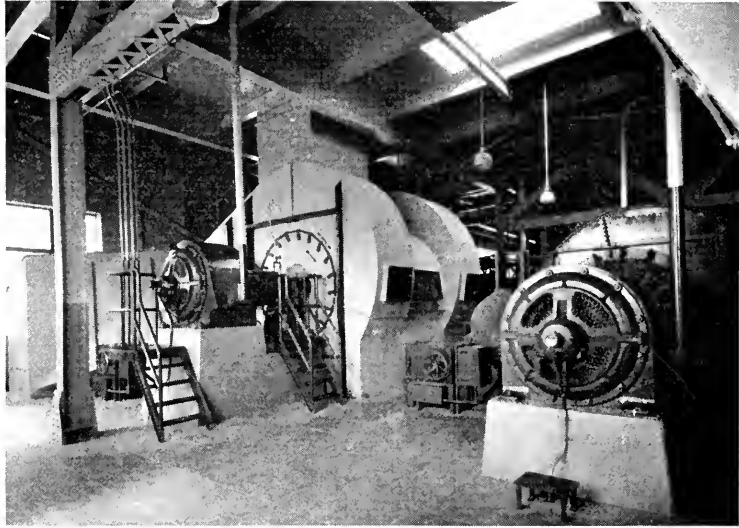


Boiler operating panel on firing floor.

The fact that speed and stronger materials have allowed the turbine builders to make turbo-generators of smaller size has been utilized in this newest development at Station "A" in the building of the high-pressure element of this compound turbine of so small a size that a machine generating 18,000 horsepower is installed above the generator of the low-pressure unit. The high-pressure element operates at twice the speed of the low pressure, namely, 3,600 revolutions per minute, a speed that a few years ago would have been out of the question for a

turbo-generator of its size. In placing the high-pressure element above the low-pressure element, valuable floor space has been saved, which is another factor in installing such a large increase in electric-generating capacity in the building. This arrangement of turbines, one above the other, has a further advantage in that only one concrete foundation has been required for each unit, and this has been responsible for a saving of several thousands of dollars.

It will be of interest to compare the enormous amount of water in the form of steam that passes through the new high-pressure turbines in a day with the amount of water used in the city of San Francisco. With both turbines operating at full load for twenty-four hours, 3,300,000 gallons of water in the form of steam pass from the boilers to the turbines. The city of San Francisco uses approximately 50,000,000 gallons in a day, or only fifteen times as much. Fortunately,



Forced and induced draft fans for boiler No. 1.

we do not have to buy all this water every day. Each boiler holds approximately 20,000 gallons of water, or 60,000 gallons for the three boilers, and this with the comparatively small amount in the form of steam which fills the piping is all that would theoretically be required to operate the plant were it not for small leaks which occur from time to time, and for that water which is drawn from the boilers when the concentration of certain chemicals becomes too high in the boiler water. In order to provide for this loss, "make-up" water, as it is called, distilled

water storage is provided to the extent of 60,000 gallons, evaporators being installed to furnish this distilled water.

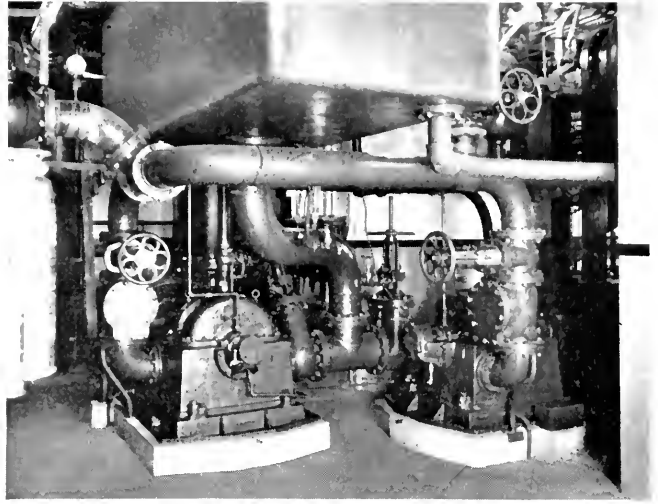
After the water is formed into steam in the boiler, it passes to the high-pressure turbine where it enters at a pressure of 1,250 lbs. and a temperature of 750 deg. F. (lead melts at 620 deg. F.); here some of the heat energy in



Another view of forced and induced draft fans, showing dual motor drive.

the steam is transformed into electrical energy and in doing so the pressure is reduced to approximately 400 lbs., and the temperature to 500 deg. F. In this transformation, approximately 18,000 horsepower has been generated by each of the high-pressure turbo-generators.

If this steam were next allowed to pass direct to the low-pressure generator, it would lose its heat energy so fast that a great deal of it would be condensed into water in the latter stages of the low-pressure turbine. This would cause the turbine buckets to wear and thereby greatly reduce the useful and efficient life of the turbine. To overcome this, the steam after leaving the high-pressure turbine is sent back to the boiler room where it passes through reheaters. Here the temperature is raised again to 750 deg. The steam then passes to the low-pressure turbine at this higher temperature, but at a slightly lower pressure than that at which it was exhausted from the high-pressure turbine. This lowering of pressure is due to friction caused by the flow of the steam through the piping and

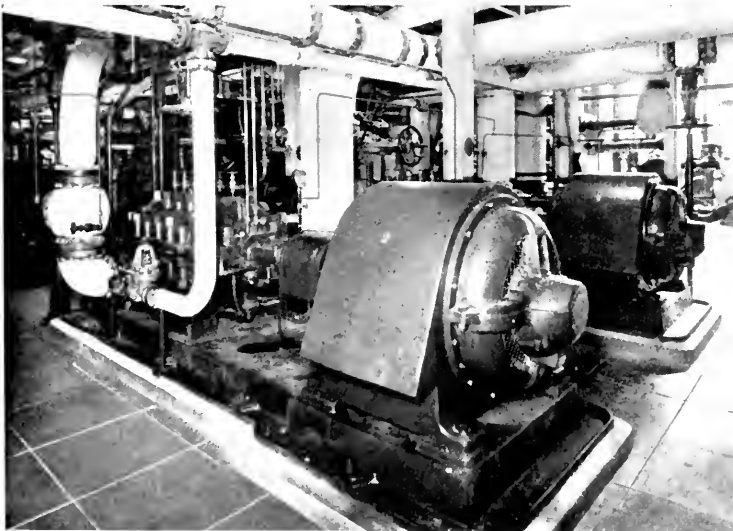


Condensate pumps for turbine No. 1 condenser.

the reheaters. As the steam flows through the low-pressure turbine, it has its energy transformed into electrical energy as it did in passing through the high-pressure turbine. The lower limit to which the temperature and pressure of the steam can drop in this energy transformation is determined by the vacuum which is maintained at the exhaust or outlet of the low-pressure turbine. This vacuum is obtained by the use of a condenser through which cold salt water from San Francisco bay is pumped, and the amount of vacuum is

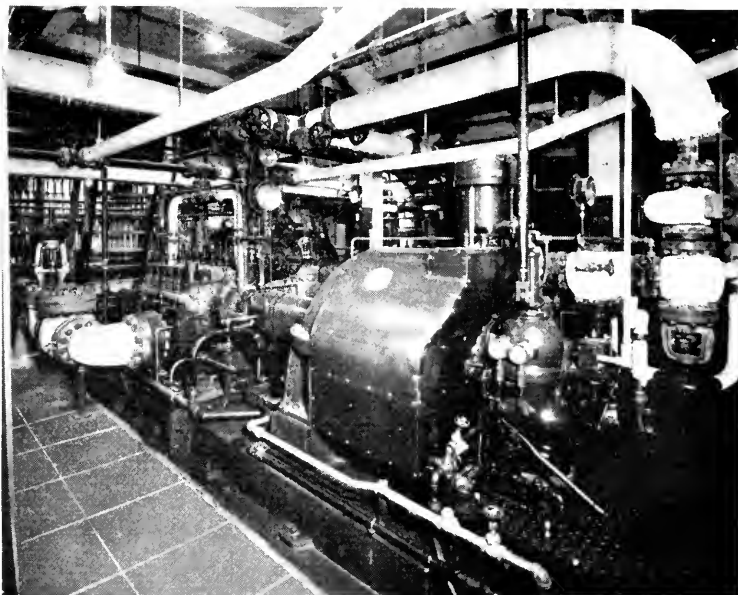
so related to the temperature of this salt water that the lower the temperature of the salt water the better the vacuum that may be obtained and, consequently, more use may be made of the energy in the steam.

As mentioned in the first part of this article, one of the advantages of the location of the station is the abundance of cold water available for condensing the steam which



Primary feed-water pumps.

has given up all its available energy in the turbine. This water is taken from San Francisco bay and the maximum temperature is around 63 deg. F. Other large steam plants in California must use condensing water whose temperature ranges around 78 deg. F. in the summer months. This 15 deg. lower temperature means that the turbines at Station "A" can operate at a vacuum of  $28\frac{1}{2}$  in. of mercury, while, if we had to use the same amount of water of 78 deg. F. temperature in the same condensers, a vacuum of only 27.6 in. could be obtained, which means that the turbines would lose considerable in efficiency and more steam would be required to operate them for the maximum output. The only way a higher vacuum could be obtained with the higher temperature water would be to use more



Secondary feed-water pumps.

water. This would increase the amount of power for pumping and would mean that less power would be available for distribution to our customers. Or, the size of the condenser could be increased, which of course would require a greater capital investment both for condenser and foundations.

The amount of salt water required for our new condensers at Station "A" is enormous,

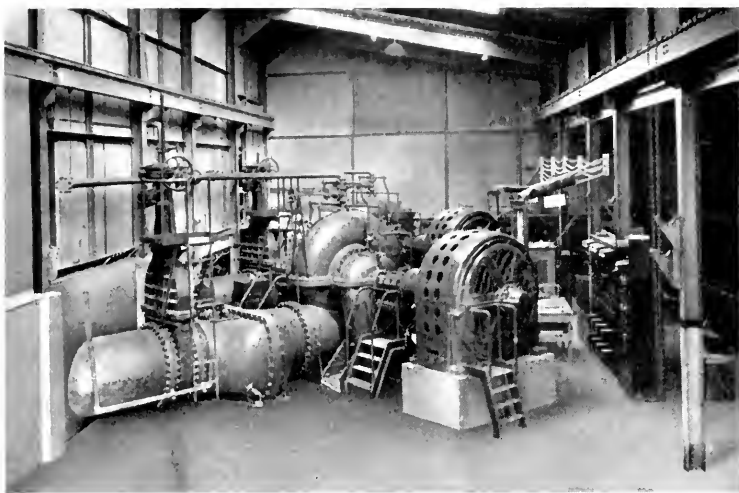
amounting to approximately 115,000,000 gallons per day. If this were fresh water it would be enough to supply the needs of a city almost  $2\frac{1}{2}$  times as large as the city of San Francisco.

The pumps which raise the salt water from the bay are located in a building about 1000 ft. east of the main station building. This building also was built at the time the station was originally designed and housed the pumps which were in use at that time. The floor of this pump house is just above high tide in the bay and originally the water flowed into



Condenser and feed-water performance instruments.

a sump below this floor through an open trench from the bay. Two 66 in. redwood stave pipes about 300 ft. long, each placed side by side in this trench and below the water level in the bay, were next used for the water flow. These pipes, after being in use for about sixteen years, were replaced in 1928 by a modern reinforced concrete conduit of ample size to supply all the salt water that will ultimately be needed for the steam station.



New circulating water pumps.

At the outer end of this conduit at the pierhead line are placed steel bars which prevent any large fish or pieces of wood or other debris from coming into the conduit with the water. The bars are, from time to time, raked free of any rubbish which may collect on them. They are not close enough together to prevent small fish or fine debris from coming through them, so finer screens which may be rotated continuously are provided just outside the pump house. As they rotate they

carry up whatever clings to them, and at a certain spot in the revolution, a stream of water under considerable pressure washes the debris into a trough which discharges into the bay. The clean screen revolves back under the water again and the process is repeated. If these screens and steel bars were not used, the debris would cause damage to the pumps which, if they were not kept clean, would become so clogged that sufficient water to operate the condensers could not be obtained.

The principal use of the finer screen is to take out small floating material which might be carried by the water into the condensers to clog the ends of the tubes through which the water flows. As these tubes are only  $\frac{7}{8}$  in. in diameter, it is evident that it does not take a very large object to clog one of them. When too many of them become clogged, the condenser vacuum is not so good and a loss in efficiency is the result. In the old style condensers, this clogging of tubes sometimes became serious and the vacuum was adversely affected to such an extent that the turbo-generator had to be shut down so that



Electrical operating room, showing turbine control panels.

men could go into the end of the condenser and clean out all these obstructions. This meant the loss of the entire generating capacity of the machine during this time. In the new condensers at Station "A," this difficulty has been overcome to some extent. The salt water compartments of the condensers are divided in half, so that one half of the condenser may be shut down at a time and opened up without shutting down the turbine. The turbine may be operated at a little more than half load while the cleaning is being done, with only a slight loss in vacuum.

The old station of 86,000 horsepower required about 100,000 gal. of salt water per minute for condenser use and the new station when completed will require only 150,000 gal., although it will be capable of generating 4 times the amount of power. Modern steam plant efficiency and advanced design are the cause of this improvement. The amount of steam passing from the low-pressure turbine exhaust to the condenser has been greatly reduced by the use of higher initial pressures and temperatures and by reheating the steam up to its original temperature after it leaves the high-pressure turbine. These conditions make it possible to generate a kw.-hr. with less steam. Extracting steam from the turbine for feed water heating also lessens the amount of steam that otherwise would go to the condenser.

The boilers which generate the steam for the operation of the plant are the largest of their type in service for the generation of steam at 1400 lbs. pressure. Each of the three boilers is capable of transforming 500,000 lbs. of water per hour into steam. When operating at full load, the two turbines require 1,150,000 lbs. per hour. The furnaces of these boilers are approximately 43 ft. wide, 25 ft. high and  $16\frac{1}{2}$  ft. deep, giving a volume of 17,700 cubic feet. The largest furnace on any of the old boilers at Station "A" contained only 2100 cubic feet. In fact, these new furnaces are nearly large enough to hold two of the largest of the old boilers.



Electrical operating room, showing outgoing feeders and switch control.

The air heater which forms a part of the boiler plant is responsible for the saving of most of this waste of heat which otherwise would be discharged to the atmosphere. At maximum load on the boiler, atmospheric air to be used for the fuel burning is forced by a large motor-driven fan, called the forced draft fan, around the tubes of this air heater and to the burners at the boiler front. The air is raised in temperature, taking heat from the hot gases which pass through the inside of the tubes. Under full load conditions, this forced draft fan forces over 6500 tons of air through the air heater every 24 hours. After this air has been used for combustion of the fuel, another fan, called an induced draft fan, pulls the gases over boiler surfaces and discharges it to the atmosphere. This fan handles over 7300 tons of gases every 24 hours. The average person requires about 1800 cu. ft. of air per hour to be maintained in good health. When the plant is operated at full load enough air is supplied to the boiler for nearly 10,000 human beings.

In order that the large amount of burned gases from the boilers might not be objectionable to the occupants of neighboring factories, it has been necessary to discharge them from a high chimney reaching far above the surrounding buildings. This chimney rises 200 ft. above the boiler room firing floor. When the original plant was built in 1901, a steel chimney lined with brick was erected for the old boiler plant. This chimney is still standing after a period of thirty years. The

average life of an unlined steel chimney is only about ten years. The new one has been lined with a reinforced gunite (wet cement blown on wire mesh) and it is felt that by this method the chimney will last for the full life of the plant. The steel ducts leading from the induced fans to the chimneys are lined in a similar manner.

One of the ways in which a saving in heat has been made in the new plant has been by the use of a number of feed-water heaters which raise the temperature of the water going to the boilers a few hundred degrees above that it would have after leaving the condenser. For instance, the condensed steam as it leaves the condenser has a temperature of around 90 deg. F. and if this was pumped to the boiler enough fuel would have to be burned in the boiler to raise the temperature of this water up to 590 deg. F. before it could be evaporated into steam. By the use of the feed-water heaters, the temperature is raised to 430 deg. F. and the amount of fuel saved is the amount that would be required to raise the temperature of the water from 90 deg. to 430 deg.

Steam that has been used to generate some power is taken from different places in the turbine as it passes along to the condenser and this steam, taken to the different heaters, raises the water temperature to within a few degrees of the temperature of the steam. The first heater the water passes through, has its shell connected to the fourteenth stage of the low-pressure turbine. This heater, like all the other heaters, acts in a way similar to the main condenser, only, instead of salt water, it uses the feed-water on its way to the boilers, passing through its tubes, and this water going into the heater at a colder temperature than that of the steam, condenses it and induces more steam to flow from the turbine into the heater. The second heater is connected to the tenth stage of the low-pressure turbine, the steam from which is at a higher temperature. This heats the water still higher. Steam for heating the water in the last two heaters is taken from the exhaust of the high-pressure turbine before it goes back to the boiler to be reheated. Between the high-pressure turbine exhaust and the first of these last two heaters is connected a turbine of 1200 horsepower which drives one of the pumps forcing water into the boilers. This heater acts as a condenser for this turbine. The last heater takes its steam direct from the high-pressure turbine exhaust as men-

tioned above.

There are three pumps which are used to pump the boiler water from the condenser into the boiler. The first of these pumps is connected to the condenser and pumps the water from the condenser through the lowest temperature heater into a deaerating heater. The function of this deaerating heater is to remove all traces of oxygen from the water. Should oxygen succeed in reaching the boiler, it would attack the steel on the inside of the boiler parts and destroy it in time. From the deaerating heater, the water flows to the second pump which forces the water through all the remaining heaters to the suction of the last pump which forces the water into the boiler.

The work of reconstruction at Station "A" started early in 1928. The first of the new turbines was placed in operation on February 7 of this year and the second on June 20. Up to September 1 unit No. 1 had generated 161,250,000 kilowatt-hours and unit No. 2, 68,720,000 kw.-h.

Natural gas has displaced oil as fuel for the boilers. At the present time, with two turbines running nearly at maximum load, approximately 27,000,000 cu. ft. of natural gas is burned every twenty-four hours. Only about  $1\frac{1}{2}$  times as much gas is used in San Francisco for all other purposes.

An interesting comparison that brings immediate attention to the great improvement in efficiency of the new plant over the old may be seen from recent operating records. On April 9, the new plant generated 1,080,000 kw.-h. and used 10,403,000 cu. ft. of gas. The old plant at the same time used 10,635,000 cu. ft. and generated 475,000 kw.-h., or less than half as much.

The old building at Station "A" is of brick and had to be altered but little to house the turbines and boilers and their related auxiliaries. The turbine room is 56 ft. wide inside and the boiler room 64 ft. Both rooms are 425 ft. long. Although the original building presented a rather plain appearance, it has been possible by refacing its fronts with red brick and properly placing the windows and doorways to produce an inexpensive architectural effect which is very pleasing. A new switchhouse and administration building has been added and made a part of the new arrangement.

The plant has been engineered throughout by company forces.

# The Meaning of Interconnection— Its Relation to "Pacific Service"

By A. H. MARKWART, *Vice-President in Charge of Engineering*

When consolidations are mentioned, such as that in which the Great Western Power Company, the San Joaquin Light and Power Corporation and the Midland Counties Public Service Corporation and their subsidiaries were merged with this company, the first thought that comes to mind is of the financial structure. While the exchange of securities and properties may be effected in a relatively short time, the real consolidation, which is physical rather than financial, has many ramifications in the co-ordination of operating plants and operating personnel.

Such a physical merger obviously holds much of benefit to our customers, as well as to the company, in improved service, in more effective use of existing facilities, in the avoidance of duplication in construction programs to meet future requirements and in the increased dependability which comes with the interconnection of a number of plants in one far-reaching system. Some of these benefits were operative at once, as soon as the interconnections were effected; others will require

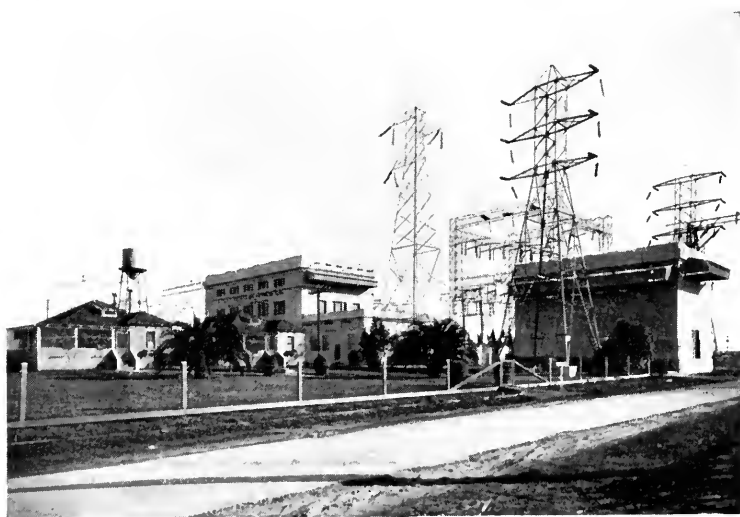
a period of years during which the operating relations between the component parts of the new system are being gradually established.

The interconnection of separate power systems has been an established practice for many years, a good example being had in the early history of the Pacific Gas and Electric Company, which even prior to the recent merger was, in effect, a consolidation of a number of smaller systems. These early consolidations furnished the precedent, and from the experience gained, the physical and economic advantages of such interconnections were thoroughly appreciated.

In general, interconnections render possible the fullest utilization of the facilities of a combined hydro and steam-electric system. They permit reserves to be minimized. They allow for the diversity which exists in stream-flow. They tend to reduce the total amount of auxiliary steam-electric generating capacity in a combination of systems, largely hydro-electric. Finally, they permit taking advantage of the diversity of peak demands

in the constituent systems, since their simultaneous peak at the instant of highest demand is as a rule somewhat below the sum total of their individual peaks.

To some extent early interconnection was brought about in the "Pacific Service" system, as it grew from small beginnings to secure these many benefits. These doubtless were not the controlling factors, however,

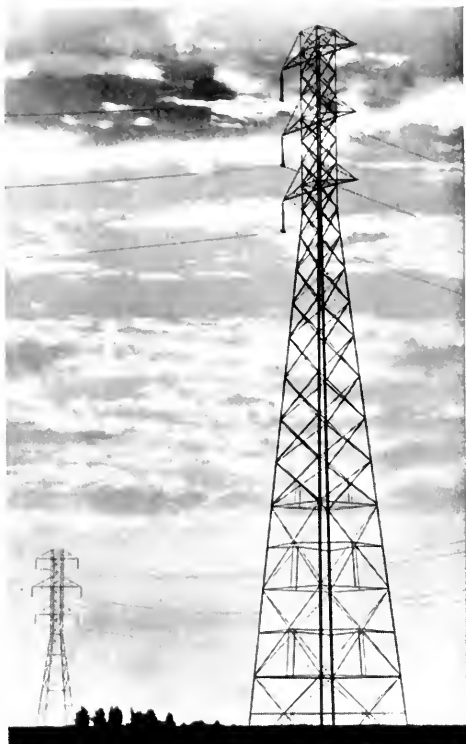


Brighton substation, near Sacramento, northern terminus of the Great Western-San Joaquin tie-line.

since the magnitude of these advantages in the past was not great, due to the small capacity of the early interconnections. These initial interconnections, nevertheless, revealed the significance of the idea and tested its inherent values. Now the full benefits of interconnection are had, because the ties are of such capacities as will handle sufficiently large blocks of power to bring them to realization.

What really was sought in the early history of electric utility mergers was the elimination of competition and the control of markets. While it is true that the early pioneers had a greater profit to themselves in mind, the reductions in cost following the consolidations came to the consumer automatically. With the inception of state regulation, as we know it today, destructive competitive conditions, with the burden of cost which they inevitably put upon the consumer, were removed forever. Today, because of an enlightened and unselfish policy, the incentive grows out of a constructive desire to consolidate markets and to forestall the investment of capital in duplicate distribution systems in a given territory and to obviate the corresponding operation cost in the consumer interest. Past and present, the consumer interest was, and is, benefited by these consolidations, despite the fact that in the past perhaps the motivating spirit was selfish.

As soon as the corporate merger between the Pacific Gas and Electric Company and the Great Western and San Joaquin Companies had been accomplished, studies were

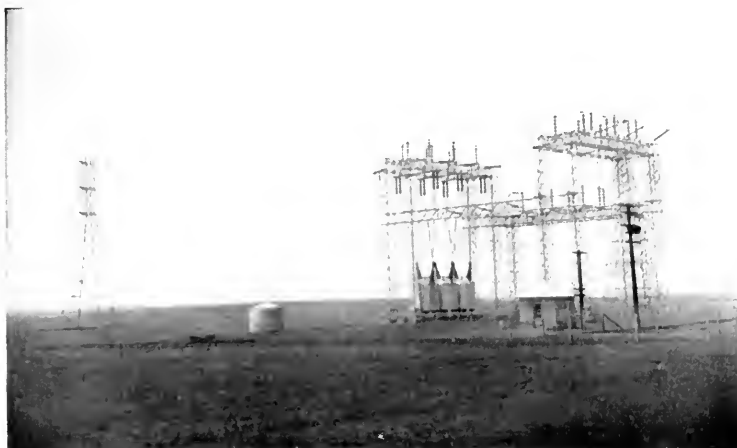


167-ft. tower at point where the 220-k. v. Brighton-Merced line crosses the Hetch-Hetchy lines of the city of San Francisco.

undertaken by the Department of Engineering to determine the initial steps which should be made to insure continued adequacy and reliability of the power supply through-

out the 85,000 square miles of combined territory served. Each of the several companies brought something to the consolidation which would strengthen the whole, were the most to be made of these elements and were they to be consistently incorporated into a comprehensive system.

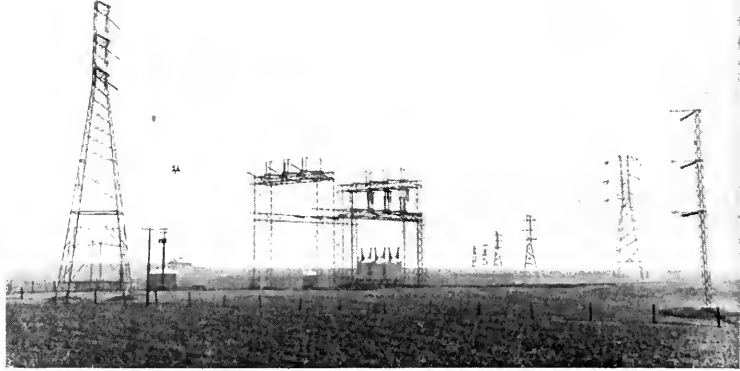
As the outgrowth of these



Bellota substation, showing 220-k. v. oil circuit breaker, steel switch structure and transmission towers.

studies, two major tie-line connections have been completed which provide for the interchange of power between the Pacific and Great Western systems, on the one hand, and between the Pacific and the San Joaquin systems on the other. These augment the tie-line which existed between the Great Western and the San Joaquin systems and are of first order importance to the reliability of service throughout the consolidated system.

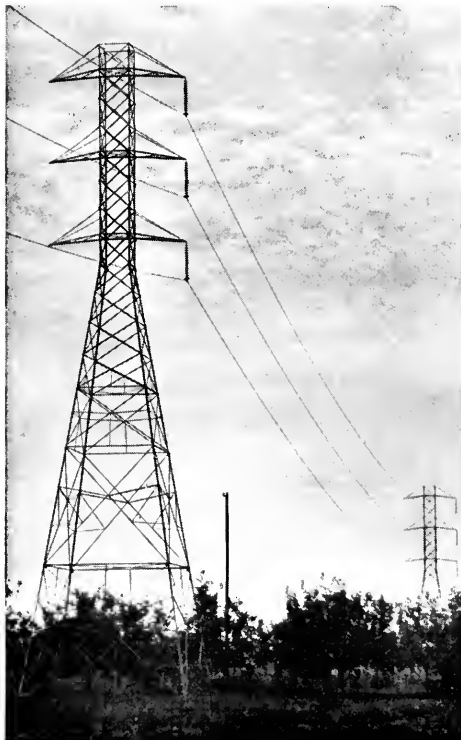
The first step, in which the Pacific and Great Western systems were interconnected



Bellota substation, showing short section of Pacific-San Joaquin tie-line in the background.

at Claremont Substation, in Oakland, was described in the July number of *PACIFIC SERVICE MAGAZINE*. This connection places the generating and standby facilities of the Pacific system at the disposal of the Great Western system, and it is particularly valuable to the latter on account of its somewhat limited transmission facilities, at this time, from Brighton Substation, near Sacramento, to the Bay Region. It furnishes, furthermore, a power supply there to meet Great Western load growth, thus permitting the indefinite continuance of the power deliveries which Great Western has been making to the San Joaquin from Brighton Substation, near Sacramento, to Wilson Substation, in the vicinity of Merced. Conversely, as circumstances may require, the Claremont interconnection makes it possible to introduce Great Western power into the Pacific system, when and as there may be a surplus.

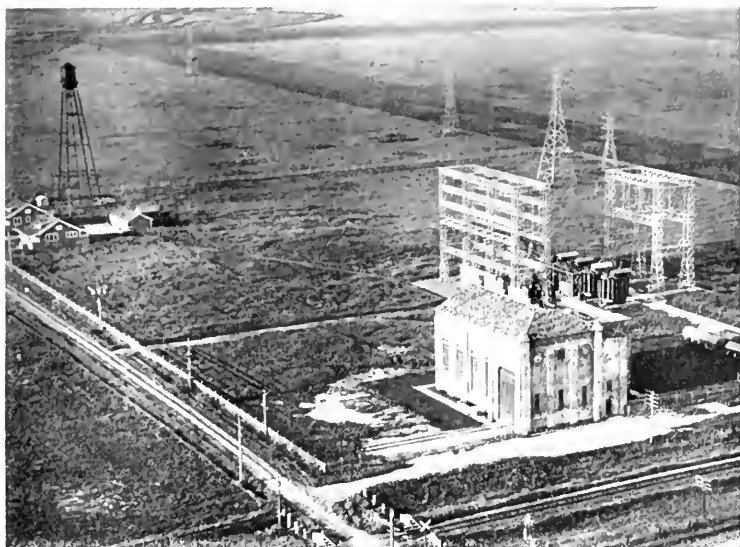
The second step was the construction of a 220,000-volt transmission line and substation, at a cost of approximately \$1,150,000 to provide an effective interchange connection between the Pacific and the San Joaquin systems. Engineering studies subsequent to the merger early indicated that, should there be limited rainfall in Northern and Central California during the winter of 1930-31, the existing power supply in the southern territory would be inadequate to meet the demand during 1931, with what was considered a satisfactory margin of reserve. Plans were accordingly hurried to completion for the construction of a 220,000-volt transmission



Standard 220-k. v. suspension tower, Brighton-Merced line.

line extending from Bellota, 12 miles east of Stockton, to Herndon, a distance of 102 miles, and the construction of a step-down substation at the latter point of sufficient capacity to deliver approximately 100,000 horsepower to the San Joaquin system.

Preliminary work was started in the field late in 1930 and, despite the fact that the Mokelumne River Development and other major projects were under construction at the same time, the new sub-

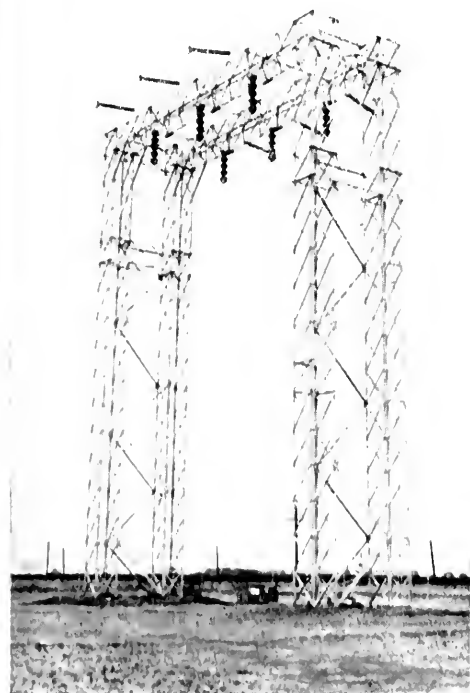


Wilson substation, near Merced, at the southern end of the 105-mile transmission line from Brighton.

station and tie-line were completed at record speed and ready for operation on June 28, 1931. The deficiency in rainfall during the past season is now a matter of history and the urgent necessity for this added service can best be realized from the fact that on July 19, of this year, the new substation was called upon to deliver 113,000 horsepower to the San Joaquin system and, on July 28, 105,000 horsepower. The 1931 peak load of the San Joaquin system, amounting to 262,000 horsepower, occurred on July 15, just seventeen days after the new line and substation were placed in operation, at which time a block of 94,000 horsepower was delivered over the tie-line from hydro-electric plants of the Pacific system.

The northern terminus of the Pacific-San Joaquin tie-line taps the Tiger Creek-Newark 220,000-volt lines at Bellota, where the Brighton-Wilson 165,000-volt line of the Great Western system crosses the Mokelumne lines of the Pacific system. The tie-line can thus be connected to either of the two Mokelumne lines, and power can be delivered to the San Joaquin system from hydro plants located on the Mokelumne River, from Newark Substation, as described in the July number of *PACIFIC SERVICE MAGAZINE*, or simultaneously from both sources.

One interesting feature of the equipment located at Bellota is the supervisory control which permits the disconnecting switches and

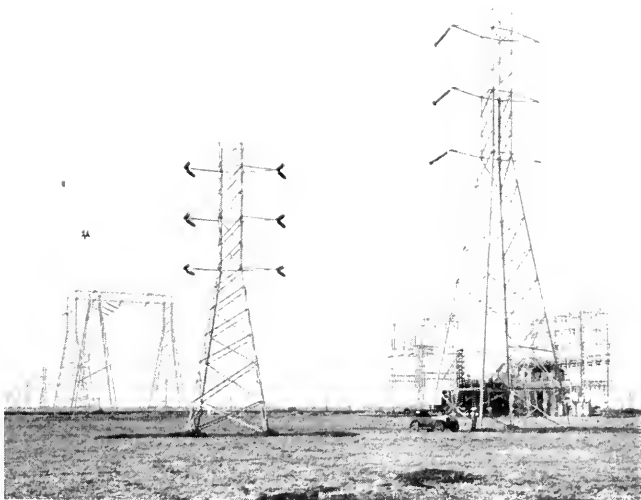


Dead-end tower at Wilson substation for the Bellota-Herndon line.

oil circuit-breaker to be electrically operated from Substation "A," in Stockton. Selective switching can be performed by this method, through 12 miles of control circuit, in much less time than would be required to operate the switches manually through an operator in attendance at Bellota. A lamp indication on the control panel positively reports the open or closed position of each switch and informs the operator at Stockton at a glance precisely which lines and switches are in service at Bellota, and which are not.

From Bellota the tie-line extends a distance of approximately 60 miles to the Wilson Substation of the Great Western Power Company, near Merced, and from Wilson Substation it continues approximately 42 miles farther to Herndon. The section north of Merced was constructed on a vacant position of the Brighton-Wilson steel-tower transmission line, while the section south of Merced utilizes a vacant position on the Wilson-Ashlan tower line, thereby reducing the capital investment which would otherwise have been needed.

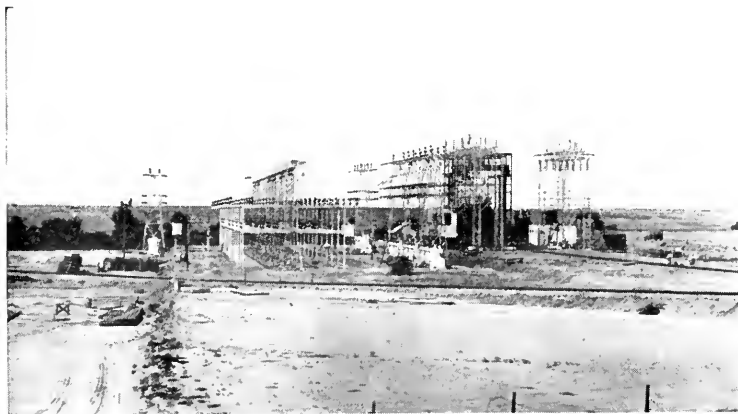
Herndon Substation is conveniently located near the load center of the San Joaquin system, and this site, in the outskirts of



Transmission lines in the vicinity of Wilson Substation.

Fresno, has also been selected for the San Joaquin steam-electric generating plant proposed for construction during 1932. At Herndon, the main transformer equipment consists of four units of approximately 33,300 horsepower each, arranged to operate in a bank of three, with the fourth serving as a spare. These units are of such huge size and weight that specially designed flat cars were required to transport them from the factory and a heavy steel frame structure, equipped with an electric hoist, was constructed at the substation for handling them. Each transformer when filled with oil weighs 228,000 lbs., or 114 tons. Cooling is accomplished by

means of electrically-driven fans which start when the temperature reaches a certain predetermined value and shut off automatically when the temperature drops sufficiently. Power is received from the Pacific system at 220,000 volts and delivered to the San Joaquin system at 110,000 volts or, conversely, power can be

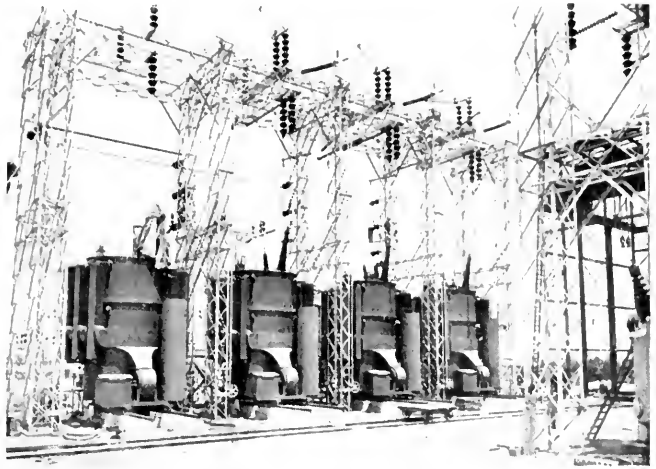


Herndon substation, near Fresno, showing outdoor steel structures, oil circuit-breakers and related equipment.

received from San Joaquin at 110,000 volts and delivered to the Pacific system at 220,000 volts through the Bellota and Newark substations. A transformer connection has also been provided for future use at 11,000 volts, which will be the generating voltage of the proposed San Joaquin steam-electric plant.

One 220,000-volt and five 110,000-volt oil circuit-breakers control the power supply from the 220,000-volt tie-line and the output to the 110,000-volt lines radiating from the substation to various points of the San Joaquin system. Switchboards and control equipment are housed in a modern steel frame and concrete building which can be readily enlarged when additional space is required for the future steam plant auxiliaries. Modern carrier current telephone equipment provides a very flexible communication service between this substation, the system load dispatcher in Oakland, the Tiger Creek plant on the Mokelumne River, the Newark Substation, Substation "J," Oakland, and the San Joaquin load dispatcher in Fresno. The carrier current telephone makes possible the transmission of messages over the high-voltage power circuits and incorporates the most up-to-date developments in the art of carrier telephone communication.

The third connection of major importance as a medium for interchange of system power is the Brighton-Wilson tie-line mentioned above, which has been operating a number of years for interchange service between the Great Western and San Joaquin systems. This connection and the two new ones recently completed provide the San Joaquin territory with standby service from the Great Western and Pacific systems, provide the Great Western with standby power from the Pacific and San Joaquin and provide the Pacific system with the combined standby facilities of the San Joaquin and Great Western. During times of local stress or disturbance adequate reserve power is thus available for distribution to the territory in need from strategic points having interchange facilities. Improvement in service is the immediate and



220/110 k. v. main transformer bank at Herndon.

obvious result of this comprehensive plan.

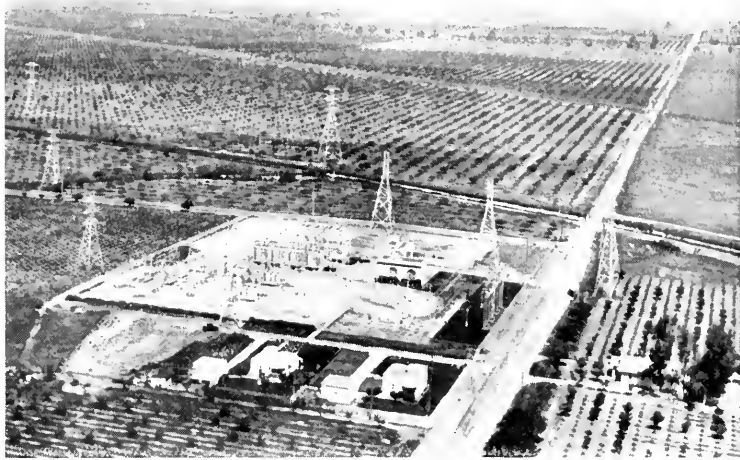
The Salt Springs and Tiger Creek hydroelectric plants on the Mokelumne River, which were completed and placed in operation in July, thus were enabled to supply a part of the much-needed power to the San Joaquin territory during the past summer. The new steam turbines at Station "A," San Francisco, relieved the demand on the hydro supply and furnished power to be diverted over the Oakland tie-line to the Great Western system. With this added service, the Great Western was in a position to supply San Joaquin with the balance of power needed to meet its requirements and the San Joaquin Company, in turn, was permitted to keep some margin of hydro power in reserve for an emergency. In effect, the interchange tie-lines, with no additional generating capacity, improve greatly the reliability of service.

The interconnection of the Pacific and San Joaquin systems and of the Pacific and Great Western systems renders possible the meeting of the load on all the systems by the stream-flow plants of the Pacific and San Joaquin systems during the spring months, allowing Lake Almanor, a very inexpensive storage reservoir of the Great Western system, to accumulate water during this period for use by all of the systems in the late summer months, when the water available for the stream-flow plants is little or nothing. This advantage was realized in the Great Western and San Joaquin systems through the agency of their interconnection some years ago by

means of the Brighton - Wilson tie-line mentioned above.

The meaning of this facility in the exchange of energy among the consolidated companies may best be appreciated from the effect which the inter-connections have had upon the system peaks. During 1930, had there been no tie-in of the Great Western and San Joaquin systems, their independent peak loads would have been 208,000 horsepower and 264,000 horsepower respectively, giving with the 711,000 horsepower of the Pacific system an arithmetical peak load of 1,183,000 horsepower. With the three systems consolidated, however, the combined peak was actually 1,143,000 horsepower, indicating a reduction of 40,000 horsepower in the simultaneous peak.

This constitutes an increase in reserve of that amount, which may be dispatched when and where needed and upon which reliance can be placed should emergencies arise. Considering it from another angle, and assuming



Airview of Ashlan substation, north of Fresno,  
50 miles from Wilson substation.

that the existing reserves are adequate, this 40,000 horsepower acts to reduce, by that amount, the installation next to be made to meet growth, requiring, as a consequence, less capital in an amount equal to the cost of 40,000 horsepower of generating and transmitting capital.

These figures emphasize the importance, both to the company and its customers, of a physically consolidated regional system which not only can take advantage of a diversity of loads but, at the same time, is prepared to meet adverse operating contingencies.



# Stockton the First City in State to Receive Natural Gas Service

By J. E. KELLEY, Assistant Engineer, Gas Department

The city of Stockton enjoys the distinction of being the first community in the State of California to be served with natural gas. The first natural gas well in Stockton was drilled in the year 1864 and was located on the site of the present county court-house. The well was being drilled for a water supply when the drill struck an artesian flow of water which contained considerable natural gas. After striking the gas flow it was decided to go deeper and the well was drilled to 1100 feet deep. This well supplied the court-house with gas and also supplied warm water which had a temperature of about 75 degrees, to the old Weber Swimming Baths, which were located on the site of the present Hotel Stockton. The well gave out about the year 1895.

The drilling of the second well was started



First natural gas well, with holder.  
Stockton Natural Gas Company.

about 1884 on the Soloman Ranch, about two miles south of French Camp. This well was being drilled to get an artesian flow of water for irrigating the farm. Due to the chemicals in the water it was not suited for irrigation. The well was about 1250 feet deep and supplied the ranch with gas for many years. The tank and house are still

standing over the well.

The third well drilled was called the McDougald well and drilling was started about 1885. It was located in the southwestern section of the city close to the McDougald Canal and the highway to French Camp. This well was about 970 feet deep and proved a failure as it produced very little gas.

In 1886 Jerome Haas organized the first natural gas company and called it the Stockton Natural Gas Company. Shortly after forming the company they started drilling a well on the property at Lincoln



Second well, Stockton Natural Gas Company.

and Lafayette Streets which is now the site of the Pacific Gas and Electric Company's warehouse. The well was completed in 1888 and was 2260 feet deep. It produced 80,000 cubic feet of natural gas per day. Gas mains were laid to the business section of the city and natural gas supplied to the consumers competing with the Stockton Gas Light and Heat Company which were supplying the city with manufactured coal gas. The second gas well on this property was completed in 1890 and was 1800 feet deep. Due to casing trouble, the first well gave out in 1891 and the second well in 1924. About the time the first well commenced to fall off in the production of natural gas the company erected a plant to manufacture gas from gasoline to be mixed with the natural gas. The Stockton Natural Gas Company was taken over by the old gas company about 1895.

In 1889 there were three natural gas wells drilled. One was drilled by the Northern Natural Gas Company in a lot on Acacia Street between San Joaquin and Hunter Streets. This well supplied natural gas to the consumer in that district. The holder and cap over the well are still standing on this property. The second well was drilled by the State on the asylum grounds and supplied gas to the State Hospital. The third



Third gas well, Stockton Natural Gas Company.

well was on the Kidd Ranch and supplied the ranch house for many years.

The nine years between 1890 and 1899 seventeen natural gas wells were drilled. Father O'Conner, pastor of St. Mary's Church, had two wells drilled on the old convent grounds at Taylor and San Joaquin Streets. These wells supplied natural gas to the convent and to consumers along San Joaquin Street between Hazelton Avenue and Washington. The surplus gas was sold to the Stockton Gas and Electric Company and used under the boilers at their electric power plant at Hazelton and Center Streets.

John and Surn Jackson, who owned the property which is now the site of the Municipal Baths, drilled two wells a few feet east of the baths. These wells supplied

consumers on San Joaquin Street between the wells and Taylor Street, the surplus gas being sold to the old gas company. The water from the wells supplied a swimming pool built by Jackson, which is now the Municipal Baths; the wells are still supplying water to the baths.

The State drilled its second



Stockton Natural Gas Company's property after purchase by Stockton Gas Light and Heat Company.

well on the asylum grounds and the county drilled a well on the jail property at San Joaquin and Channel Streets. This well supplied the jail and court-house until it gave out.

The Citizens Natural Gas Company drilled its first well in a lot on Commerce Street between Rose and Vine Streets, and the Central Natural Gas Company drilled their first well in a lot on American Street between Miner Avenue and Channel Street. Both of these natural gas companies supplied natural gas to consumers in the vicinity of their wells. One well was drilled by the Stockton Natural Gas Company in a lot at the corner of Grant and Fremont Streets and supplied consumers in that district. The Crown Flour Mill, now known as the Taylor Mill, drilled a well on the bank of the Stockton Channel at the mill and used the gas to light the mill. The water from this well was used in the condenser on the steam engine that operated the mill. The old California Paper Mill drilled a well on the south bank of Mormon Channel at Lincoln Street and the gas was used to light the mill. The water from the well was used in the condensers.

A well known as the Tripe House well was drilled in a lot at Charter Way and Lincoln



First gas well of Stockton Gas Light and Heat Company.

Street. This well supplied gas to a slaughter house and in later years to the Clark Sanatorium. Another well was drilled on West Lane, but do not remember the location of this well.

About 1896 the Stockton Gas and Electric Company drilled its first well on the property about 100 feet from the wells of the Stockton Natural Gas Company on Lafayette and Van Buren Streets; they also completed two more wells; one of these was drilled at Harding Way and Hunter Streets, and the other at Pilgrim and Anderson Streets. The well at Harding Way and Hunter Street now supplies the high school swimming pool with warm water and also part of the water for flushing Yosemite Lake.

A short time after these wells were completed the company installed two twin cylinder Otto gas engines in their power plant to generate electricity with natural gas to supply the street railroad. The old Stockton Natural Gas Company was taken over by the Stockton Gas and Electric Company and they supplied both natural and manufactured gas in separate mains to the consumers.

In the seventeen years between 1900 and 1917 nine wells were drilled. In 1900 the county drilled



Old drilling rig used for gas well boring.

a well at the County Hospital at French Camp and the Stockton Gas and Electric Company drilled a well at Miner Avenue and Harrison Street. About 1903 the glass factory which was located just south of the Municipal Baths drilled two wells to supply the glass factory with gas. The water from these wells is now supplying most of the water for the Municipal Baths.

In 1904 the Citizens Natural Gas Company drilled its second well at Harding Way and Edison Street and the Central Natural Gas Company in 1907 drilled its second well in a lot on Miner Avenue between Hunter and San Joaquin Streets. The water from the Citizens Natural Gas Company well is still being run to Yosemite Lake.

In 1908 the Stockton Gas and Electric Company drilled a well at Miner Avenue and Wilson Way. The well proved to be the best producer of natural gas struck around Stockton. The water from this well supplies the Olympic Baths. In 1910 the Stockton Gas and Electric Company was taken over by the Western States Gas and Electric Company, and in 1912 they drilled the deepest well in Stockton. This well is 3180 feet deep and is located in a lot on El Dorado between Miner Avenue and Channel Street.

The last well drilled in Stockton was in 1917 when the Western States Gas and Electric Company drilled a well 2900 feet deep on the property across the canal from the Santa Fe roundhouse at Charter Way and Baker Street.

There have been several natural gas wells started but never completed. In all thirty-three wells were drilled in the Stockton district and twelve of them still produce gas. The production of natural gas varied from 5,000 cubic feet per day in the smaller wells to 120,000 cubic feet per day in the best producers. When the wells were first brought in the artesian flow of water varied from 200 gallons per minute in the small wells to 1,800 gallons per minute in the larger wells. The temperature of the water from the gas wells varies from 75 to 96 degrees. Few of the wells still have an artesian flow of water, but most of them now in operation have to be forced with compressors to produce gas and water.

Most of the natural gas companies had to

purchase gas from the Western States Gas and Electric Company when their wells started falling off in production and all of them were taken over by the old company at different times. Prior to 1911 manufactured and natural gas was supplied to the consumers in separate mains. In 1911 this was changed and all the natural gas was piped to the gas plant and mixed with manufactured oil gas and the consumers supplied with a mixed natural and oil gas.

In 1927 the Pacific Gas and Electric Company took over the Western States Gas & Electric Company and in 1930 piped natural gas from Kettleman Hills and Buttonwillow fields and started serving all the consumers with straight natural gas. The plant for the manufacture of gas was shut down in July, 1930, the first time in seventy years that gas was not manufactured in Stockton.

The natural gas around Stockton is a marsh gas and has an average heat value of 730 British thermal units per cubic foot. The gas from the shallow wells has a heat value of 650 British thermal units and the deep wells around 800 British thermal units. The pressure of the wells is very low, being less than one pound per square inch. The natural gas from Kettleman Hills is a wet gas, being associated with oil, and has a heat value of 1180 British thermal units. The pressure at the wells is around 2500 pounds per square inch. The natural gas from the Buttonwillow fields is a dry natural gas and has a heat value of about 1000 British thermal units. The pressure at wells is about 1100 pounds per square inch.

The old-time drillers went through many days of hard work in drilling wells with their light drilling rig and hand-made tools. In some wells it took months to recover lost tools from the wells and they had to make all of their special cable tools for fishing jobs. Some of the older wells in Stockton took from one to three years to drill to 2000 feet, due to casing trouble and fishing lost tools out of the wells. These wells are shallow wells compared with the present day wells which are over 7000 feet deep. Due to the extensive drilling in the oil fields great improvements have been made in drilling methods and well-drilling tools. When the last well was drilled at Stockton in 1917 it was 2900 feet deep and completed in 30 days.

# Natural Gas Appliance Exhibit Draws Large Public Following

By E. M. SEEL, Publicity Department

Natural gas held the spotlight of public attention throughout Northern California from August 31st to September 5th, 1931. The largest public display of gas appliances ever shown at one time in this country was exhibited at San Francisco's city auditorium during the Natural Gas Exposition held under the auspices of Pacific Coast Gas Association.

At Pasadena last year it was decided that San Francisco should be the meeting place for the 38th annual convention of Pacific Coast Gas Association in 1931. Natural gas was still a new factor in the domestic and industrial life of Northern California. Pacific Gas and Electric Company had just completed its 800-mile interconnected natural gas system extending from Kettleman Hills at the lower end of San Joaquin Valley as far north as Sacramento and Roseville, and with the approaching convention to be held in the heart of Northern California, the possibilities of further educational work became apparent. The physical work of changing over approximately one-half the population of California from a manufactured to a natural gas basis had already been accomplished, but there still remained thousands of consumers who were unfamiliar with the latest and most modern designs of gas appliances suitable for the home as well as the advanced developments for industrial purposes.

The opportunity being offered of presenting the consuming public with the outstanding diversities of natural gas as a fuel, the idea of a Natural Gas Exposition to be held in conjunction with the annual meeting of Pacific Coast Gas Association was conceived in the general sales office of Pacific Gas and Electric Company. Manufacturers and jobbers were sounded out, and their favorable reaction was immediate and enthusiastic.

Since the proposed Natural Gas Exposition was to be held in territory served by Pacific Gas and Electric Company, a large share of responsibility for the exposition's success was borne by that organization. Committees were appointed and charged with the

countless details of securing dealer co-operation, of arranging exhibits, and inaugurating spectacular and novel attractions designed to arouse public interest. Mr. H. M. Crawford, General Sales Manager of Pacific Gas and Electric Company, was appointed chairman of the Natural Gas Exposition Committee, with Mr. G. P. Egleston, General Manager of H. R. Basford Company, as Director of Exhibits, and Mr. A. C. Joy, Manager of the Publicity Department of Pacific Gas and Electric Company, as Director of Publicity.

Modernism in every particular was the theme of the exposition. The slogan "Gas, the Modern Fuel" was adopted. San Francisco's Civic Auditorium was rented for an entire week and its mammoth halls and wide sweep of floor space were a proper setting for the anticipated crowds of visitors. The main floor of the auditorium was subdivided for appliance booths with wide aisles between, so that visitors could have ample room to inspect the equipment shown. The committee had little difficulty in disposing of this space. Hardly any personal solicitation was necessary.

The appliance dealers were unanimous in their decision that the public of San Francisco's Bay region, as well as all of Northern and Central California, should have the opportunity of knowing that the design of water heaters, of furnaces, of space heaters and stoves, had maintained its place in the vanguard of modern evolution both for beauty and ornament as well as for utility. The determination was evidenced to dispel forever all old ideas that any stove that would light was good enough, that any water heater, regardless of capacity, was sufficient for any family, and that any furnace—so long as it held together and gave forth heat—was sufficient for the average home.

Lighting experts worked hand in hand with artists in decorating the interior of the auditorium. The modernistic theme was carried out in unusual color combinations and lighting effects. Wall-hangings and stage settings illustrated the commercial and do-



Natural Gas Exhibit at the P. C. G. A. Convention in San Francisco.

mestic applications of gas as a fuel. Eighty-nine manufacturers, from nearly every section of the country, were represented in the booths, each booth being painted and draped so as to conform to the general trend of decoration.

The booths were well worthy of the attention they received. Various manufacturers went to great detail and expense in setting forth the merits of their respective appliances. Small valves were magnified many times in huge castings of aluminum and bronze in order that their simplicity and safety might be readily understood. Each booth was connected with both gas and water so that actual demonstrations would be possible.

Two features of the display attracted more than ordinary interest. These were the Modern Basement and the Kitchen of Tomorrow. The Modern Basement was constructed with one wall cut away and was

equipped with the latest gas-fired heating unit. It also demonstrated the available basement space which could be used for other purposes. It contained a boy's work bench, gymnasium, incinerator and water heater, besides the furnace. A large poster informed visitors that the "use of gas-fired devices saves basement space equivalent to adding a room where children may play safely. . . ."

The Modern Kitchen was designed in two parts to show a contrast between "The Kitchen of Yesterday" and "The Kitchen of Tomorrow." This latter was built to contain all the long-desired equipment dreamed of by the average housewife, both as to decorations and built-in conveniences. Harmony of color in both equipment and interior was stressed. This one feature alone attracted more than 30,000 visitors.

The fundamental idea back of the exposition was not a sales campaign but rather to arouse a public interest that might subse-



Appliance booths arranged on main floor of Civic Auditorium.

quently prove of value to all dealers in appliances. Notwithstanding this instructive idea, many dealers were frankly surprised at the number of sales closed on the floor of the auditorium, as well as the long lists of prospective customers obtained. These lists alone, it is thought, should stimulate gas appliance sales for months to come.

At the conclusion of the exposition it was estimated that about 60,000 visitors had been entertained. This attendance exceeded the most sanguine expectations. The idea of the exposition was a daring thing at best. Prior to August 31st, originators were constantly assailed with skeptical predictions as to its ultimate success. The chief objection of the pessimists centered around the idea that it would be impossible to interest the public and, therefore, there would be no attendance. This objection was answered by an average daily attendance of 10,000 people for the six days.

The credit for this attendance is due, in no small measure, to the offering for public education and diversion many new and original ideas, coupled with an extensive advertising campaign. Practically all forms of advertising mediums were adopted, including the daily press in the San Francisco Bay region, billboards, street car advertisements, radio broadcasts, complimentary tickets distributed by furniture and hardware dealers, department stores, plumbing and heating dealers, as well as the exhibitors participating in the exposition. Pacific Gas and Electric Company enclosed two complimentary tickets with every bill rendered its consumers during August.

Prizes amounting to a total of \$2000 were given away during the week. Each afternoon and night a musical entertainment was offered by Phil Sapiro's thirty-piece orchestra and the Simondet sextette.

# "Pacific Service" and Agriculture— Spectacular Exhibit at State Fair

By A. M. FROST, General Sales Department

An Agricultural Electrification Exhibit, which was viewed by 40,783 people and which demonstrated the use of electricity in the poultry and dairy industries, as well as for domestic uses, was displayed by the Pacific Gas and Electric Company at the California State Fair, Sacramento, September 5th to 12th.

The exhibit consisted of a model kitchen which was in the shape of a farm home, the rear wall being left out, making a stage upon which were installed electric ranges and refrigerators, as well as many small appliances. At the rear of the stage, seats were arranged under a pergola for the accommodation of practically 150 people, and demonstrations were conducted twice daily at 10 a. m. and 3 p. m. Awnings overhanging the pergola, shrubbery and lawn with sprinklers in operation created a cool and pleasant atmosphere that attracted a great many people who took advantage of the chairs provided.

In addition to the farm bungalow there was a pump-house with a 15-horsepower irrigation pump installed, as well as a domestic system; a brooder-house with two electric brooders and an ultra-violet lamp; a chicken-house built according to the specifications of the University of California, electric-lighted and controlled by time switch; a milk-house built according to University of California specifications with a milk receiver on the outside from which milk flowed over aerator coils, brine for which was supplied by a



Entrance to exhibit, showing model farm home.

Frigidaire installation with capacity for about 40 cows. Cold storage box of the "walk-in" type, with ample room for four 10-gallon milk cans as well as space for some farm products, was provided.

The latest model of De Laval separator was installed and two types of electric sterilizers with two compartment sinks for the washing of milk cans and milking equipment. Hot water was supplied by a Malsbury 5-kilowatt sterilizer unit. Steam for sterilization supplied by a 5-kilowatt Wesix steam boiler with a maximum steam pressure of 15 pounds and a capacity of 6 gallons of water equipped with pressure gauge, safety valve, water gauge, and automatic cut-out.

The cow barn, provided with three stalls, concrete floor, proper drains and the latest De Laval milking machine, was also erected in compliance with specifications of the University of California Agricultural College.

A feed-house in which a 5-horsepower hammer mill of the Stover Manufacturing Company, with a capacity of from 700 to 1000 pounds of ground feed per hour, was in daily operation. On the outside of the

building a Jacobson Speedy hammer mill of somewhat greater capacity operated by a 10-horse-power motor equipped with cyclone and feed mixer, manufactured by the John R. Gray Company of San Francisco and operated by a 3-horsepower motor, was installed and operated.

In a hot bed, six feet square, seventy feet of General Electric soil-heating cable was installed and connected with a thermostat. No attempt was made to operate this equipment for the reason September is completely off season for soil heating. However, the display occasioned considerable interest and attendants explained the operation and the possibilities of plant propagation by its use.

The buildings were arranged on a lot 75 feet in area, fenced with woven wire and metal posts supplied by the Anchor Post Fence Company. The walks were gravel, and barley was planted a week or so in advance of the show and kept mowed down by a lawn mower to avoid dust and to give all appearances of a lawn. As the buildings are of a permanent nature and will be used annually, it is planned to put in a lawn of Bermuda grass, which grows prolifically in this climate, and which will stand traffic probably better than any other grass. A hedge will be planted along the west side to provide shade and permanent trees and shrubbery will be arranged on the grounds. Shrubby planted this year was provided by one of the nurseries, most of which was removed after the Fair.

The grounds, buildings, wiring, piping, and all other work of a permanent character were installed at the expense of the Pacific Gas and Electric Company. The machinery was provided by various manufacturers who had been invited to display.



General view of farm outbuildings. Pump-house in the foreground.

Cows were provided from various herds showing at the Fair. A number of them were milked every night at 5 o'clock and the milk put through the cooling process and stored in the refrigerator. The milking operation attracted considerable attention and many people on the grounds waited for this demonstration nightly.

Two hundred baby chicks, just one day old when the Fair opened, were put in the brooder-house, and remained under the influence of the ultra-violet lamp and the electric brooder for the entire period of the Fair. The last two days of the Fair many poultrymen said the chicks had the appearance of being four or five days older than they really were. They were all of uniform size, and not one was lost during the entire demonstration. The stock was carefully selected prior to display and sufficient information is not available to prove that their apparent unusually rapid growth was due entirely to the ultra-violet lamp. It is planned to make further tests to determine the value of ultra-violet rays.

Suitable programs briefly described the exhibit, and 10,000 cardboard fans carried advertising of the company.

It is noted that the tabulation of attendance was: 12,133 showing particular interest in the poultry display, 10,531 in the dairy equipment and 3,963 in feed grinding.

## The Financial Side of "Pacific Service"

Following is a statement of income account for the nine months ended September 30, 1931, including for the full comparative period the operations of all companies now in the consolidated system:

CONSOLIDATED INCOME ACCOUNT		INCREASE COM- PARED WITH SAME PERIOD OF 1930
	9 MOS. TO SEPT. 30, 1931	
Gross Revenue (including Miscellaneous Income).....	\$66,461,931	\$1,023,001
Maintenance, Operating Expenses, Taxes (including Federal taxes), and Reserves for Casualties and Uncollectible Accounts.....	28,299,417	45,998*
Net Income.....	\$38,162,514	\$1,068,999
Bond Interest and Discount.....	11,326,388	97,345
Balance .....	\$26,836,126	\$ 971,654
Reserves for Renewals and Replacements.....	8,138,701	433,525
Balance .....	\$18,697,425	\$ 538,129
Dividends Accrued on Preferred Stock.....	6,008,639	248,474
Balance .....	\$12,688,786	\$ 289,655
Dividends Accrued on Common Stock.....	9,084,920	603,830
Balance .....	\$ 3,603,866	\$ 314,175*

\*Decrease

Additions to the Company's properties in the twelve months to September 30, 1931, required new capital outlays exceeding \$35,000,000. The carrying charges on this new capital, the major part of which was obtained from the sale of Bonds, Preferred Stock and Common Stock, will run well over \$2,000,000 per annum. Savings through refunding operations have partly offset these added charges, but interest and dividend payments in the nine months under review, nevertheless, ran about \$950,000 ahead of the first nine months of last year. Full recovery of the cost of this new capital will undoubtedly follow the continued satisfactory development of our natural gas business, the restoration of more normal operating conditions with the advent of winter rains and, we hope, an upswing in general business conditions.

Earnings for the common stock were equivalent to \$2.09 per share upon an average of 6,056,613 shares outstanding during the first nine months of 1931, compared with \$2.19 per share upon the average of 5,654,060 shares in the similar period last year. The latter figure assumes, for the purposes of comparison, that the stock issued in exchange for The North American Company's California subsidiaries was outstanding throughout both periods.

At September 30, 1931, the total outstanding and subscribed common stock aggregated 6,227,358 shares, upon which earnings for the first nine months were equivalent to \$2.04 per share.

Sales of electricity in the nine months' period aggregated 2,575,145,835 kilowatt-hours, an increase of 47,484,295 kilowatt-hours, or 1.88%. The best increases have been in the domestic and commercial fields to which our selling activities have been most actively directed. Oil fields, mining, railway and general power sales fell off by 86,495,708 kilowatt-hours, or 6.50%, due to the general business depression, whereas drought conditions materially increased sales of agricultural and resale power. The latter item increased 44,589,860 kilowatt-hours, or 40%, due chiefly to sales by the San Joaquin Company to the Modesto-Turlock Irrigation District, and sales by the Pacific Company to the Sierra Pacific Electric Company for distribution in Nevada.

Gas sales in the nine months, excluding company uses in its steam plants, were about twenty and three-quarters billion cubic feet, as against about seventeen billions in the corresponding period of 1930, but with a somewhat smaller gross. Domestic users' billings are running at the rate of about \$4,000,000 per annum below 1929 billings for manufactured gas, due to the higher heat content of natural gas. The extent of the recovery due to the wider uses of natural gas induced by its greater economy as contrasted with manufactured gas may be inferred from our estimates that in the first full year of natural gas service, domestic billings would be reduced by \$8,750,000 below the last full year of manufactured gas service.

The present water shortage, the severest of record, has materially increased the cost of our operations, and might have proven exceedingly troublesome except for the fact that our Mokelumne development, which was begun four years ago, and our large new steam installation in San Francisco started two years ago, brought in 185,000 h.p. of additional installed capacity just at the crucial period. We were thus enabled to carry the accumulated shortage of hydro power — our own as well as that of others — all the way from Bakersfield to Carson City and Reno, Nevada. We have, of course, been short of water at our own hydro plants, except those on the Pit River. Other producers from whom we ordinarily buy large quantities of power have been unable to make deliveries. Others to whom we sell increased their demands on us and, in some cases, we have found ourselves in the reversed position of delivering instead of receiving power. Our September operations afford a good illustration. In September of last year we received 68,763,000 kilowatt-hours under our contract with other producers. In September of this year we received 18,544,000 kilowatt-hours, a cut of 50,219,000 kilowatt-hours, or 73%. Last September, Hetch Hetchy delivered to us nearly thirty million kilowatt-hours; this September less than three million kilowatt-hours, a drop of 90%. Last September the Turlock Irrigation District delivered to the San Joaquin Company twelve million kilowatt-hours; this year the process was reversed and the combined Modesto-Turlock Districts took nearly five million kilowatt-hours from the San Joaquin Company. Last September the Sierra Pacific Company, operating largely in Nevada, took from us less than a million kilowatt-hours. This September it required nearly five and one-half million kilowatt-hours to meet their demands. I think we are entitled to look with a great deal of satisfaction on the manner in which we have been able to meet not only our own emergency conditions, but to be of help to others likewise affected by the drought.

A noteworthy feature of our September operations was the net addition of 7,583 customers, the largest increase in any single month during the current year. At September 30, 1931, there were 1,260,387 active meters in service, a gain of 30,222 in the past twelve months.

# Pacific Service Magazine

PUBLISHED QUARTERLY IN THE INTERESTS OF

PACIFIC GAS AND ELECTRIC COMPANY

FREDERICK S. MYRTLE · EDITOR-IN-CHIEF

PACIFIC GAS AND ELECTRIC COMPANY

245 Market St., San Francisco

*The Pacific Gas and Electric Company desires to serve its patrons in the best possible manner. Any consumer not satisfied with his service will confer a favor upon the management by taking the matter up with the division headquarters.*

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Edison is dead.

He toiled at his self-appointed tasks, day in, day out, until the human machinery could stand the strain no longer. At 84 years of age his mentality was apparently unimpaired, but his body was worn out. He realized his hour had come and he laid down life's burden, at the last, not only resignedly but cheerfully. He could do no more, he said, and he was ready to go.

And so another great name is added to the international roster of men who have blazed the trail of progress and have left enduring fame behind them. In the public estimate throughout the civilized world Edison ranks among the first six greatest men who ever lived. No one has ever questioned his right to this distinction. His record of achievement speaks for itself. Furthermore, his aims were ever of a constructive, never of a destructive character. Edison helped to make the world a better place to live in. He placed comfort, even luxury, at the disposal of poor and rich alike. He advanced science to the general betterment of conditions everywhere. He relieved burdens, imposed none. For that alone he deserves to be honored of mankind.

He was far from a brilliant youth in his school days. He was regarded as even something of a dunce. But, he had a purpose in life and he had application. He possessed that "capacity for taking infinite pains" which was Carlyle's definition of what we call genius. His whole life was his work, so that he lived in utter disregard of the most elementary rules of hygiene. He slept little, ate little, took no recreational exercise. His laboratory was his world. That he lived to a great age seems little short of amazing. It goes to substantiate the oft-voiced doctrine

that brain work does not kill. Brain worry may, and does, but not brain exercise in the pursuit of a life's purpose.

It has been said of him that his methods of investigation were empirical, that his results were accomplished through persistent trials and experiments rather than through strict obedience to any accepted dogmas or rules of practice. Well, allowing that to be true, his empiricism was surely that of a thoroughly trained mind, with practical concepts as bases for his experiments. Also, his accomplishments were all the more remarkable for they betrayed the character of man he was, purposeful, plodding and persistent to the last degree, never discouraged by apparent failure but hammering away with renewed energy until the particular effort was rewarded by success. The money value of his contributions to science and human welfare cannot be estimated; it is simply incalculable. The number of patents issued in his name exceeds 1500; he is said to have averaged one every two weeks for fifty-two years.

Truly a great life. Whatever of material wealth Edison left behind may be regarded as merely incidental to the success of his endeavors; the accumulation of wealth for its own sake meant little or nothing to him. He left behind him a heritage of far greater value in his contributions to science that have worked wonders in world progress. His career stands out as an eloquent example to the younger generation generally, particularly to those who may elect to follow him along the path of experimental research.

This year of 1931 is distinguished as the centenary of the electrical industry. One hundred years ago, on August 29th, 1831, one Michael Faraday, the son of an Irish blacksmith, who from youth had been fascinated by the mysteries of magnetism and electricity, took an iron ring, wound around it two coils of wire, attached the end of one coil to an electric battery, the end of the other to a galvanometer and stood by to see what would happen. The galvanometer needle moved. Faraday had discovered the principle of electro-magnetic induction, the principle upon which our electric generators and motors of today operate. The electric dynamo was born that day. It was the starting point in the utilization of electric power to the service of mankind.

Like Edison, Faraday was a self-taught man. He was a bookbinder when he came

under the notice of Sir Humphry Davy, who appointed him an assistant in the laboratory of the Royal Institution in London. In after years Sir Humphry Davy, himself one of the world's greatest scientists and inventors, when asked to name his most significant discovery, replied "Michael Faraday." This year the scientists and electrical engineers of all countries have joined in the Royal Institution's celebration of the centenary of Faraday's epoch-making discovery.

### GOVERNMENT IN BUSINESS

"There is not a single reason why government ownership of the electric industry would result in genuinely lower rates or better service," declared the *Yreka Journal* in a recent editorial.

"Government cannot hire more talented engineers or executives than private business and it is doubtful if the best men would be willing to be spokes in the bureaucratic wheel. The government's buying power would be little different from that on any number of the great utility systems serving the country at the present time. It is true that government can borrow money at low rates of interest and exempts its properties and securities from taxation, but there is no profit to the citizen in that because loss of government revenue through tax exemption of any property must be made up by heavier taxes on other property.

"Government plants, when they lose money, make up the deficit from the public treasury, while private plants must pay their own way. It has been the experience that government in business means inefficiency in business—at the public expense. Government undertakings cannot be free from political influence. A government electric system would inevitably result in adding vast numbers of employees to the public payroll—and taxpayers would have to do the worrying.

"Today America has the best and lowest priced electric service in the world. The people have complete control over it through their public service commissions. The industry is a foremost taxpayer, employer, and purchaser of supplies of all kinds. To give it into the hands of the politicians would not only interrupt this progress, but would be the beginning of an era of higher taxes, broader paternalism and less individual and industrial freedom."

### THE P. G. & E. OUTLOOK

(Editorial in *Organized Labor*, October 10)

In 1931 Pacific Gas is having to contend with a drought more severe than that of the year 1924, when earning power was severely impaired. The business depression has this year cut the company's industrial electric load substantially. Yet the total electric current being sold is over two per cent ahead of 1930, and this in contrast with the nation's record of three per cent decline.

Through the energy and previous experience of an aggressive management, the handicap of drought and business depression seem largely overcome. Net per share for first half year held close to previous high records.

Important economies and savings from the Great Western Power-San Joaquin Light mergers—plus economical natural gas fuel to replace hydro-electric water shortage—have been the major revenue sources to offset the year's handicaps. Drought and depression are but temporary. Cheap natural gas fuel and merger economies are permanent.

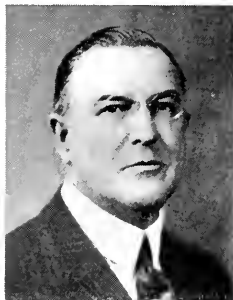
Measured by heat units, gas consumption more than doubled in the past two years. And this in spite of depressed industrial conditions. In normal business, the very cheapness of this fuel will itself attract industry to its lines. Also over 233,000 homes in Pacific Gas territory are as yet without central heating. The field for expansion of natural gas business has no more than been scratched. Congress may agitate for interstate utility regulation, yet Pacific Gas is not affected, for it has scrupulously avoided entrance into any territory outside the State of California.

Strong company with expansion ahead. Broadly diversified revenue sources in a wide territory—almost all of California north of Tehachapi. Maintained long unbroken upward trend in revenue earnings and dividends. In ten years prior to 1930 gross increased from \$34,500,000 to \$76,500,000. Net jumped from \$3,900,000 to \$19,900,000. Cash dividends grew from \$1,700,000 to \$9,686,000. Per share net increased each year but one. Dividends for 1931 should be earned by a margin of more than \$4,000,000.

P. G. and E.'s outlook has never been better, yet the stock can be bought for less than half the previous high, with a cash dividend yield of 5.4 per cent—well above the average for a high type utility—and this return without counting the value of prospective rights, seven issues of which have accrued to stockholders since 1926.

## In Memoriam

Pacific Gas and Electric Company has suffered a severe loss in the untimely passing of John Hosford Hunt, Purchasing Agent, who succumbed to a heart attack while swimming in Bolinas Bay, on the coast of Marin County, Sunday, September 13th.



John Hosford Hunt

Mr. Hunt was a native of Massachusetts, born March 19, 1868. At a very early age he came with his parents to California and settled in

San Francisco, where he received his education in the public schools. When 15 years old he entered the employ of the Sutter Street Railway Company, where he remained for twenty years, advancing by degrees to the post of assistant secretary. In 1903 he became assistant purchasing agent of the United Railways and two years later accepted a similar position with the San Francisco Gas and Electric Company. In 1906, when the local corporation became merged in the Pacific Gas and Electric Company, he became purchasing agent of the new concern, retaining that position until the day of his death.

He was one of the best-known and best-liked as well as best-informed purchasing agents in the country. He had a keen eye for the industrial market. His business contacts were unusually harmonious and he gathered hosts of friends around him. He worked hard and he played hard. In his youth he played tennis and later on he took up golf, in which he became quite proficient. Although 63 years of age, he was proud of his strength and his taking away was a shock to all who knew him.

In 1895 John Hunt espoused Miss Olive E. Cutler, of San Francisco, who survives him. There are two children of the union, John C. Hunt, employed in the auditing department of the Pacific Gas and Electric Company, and Mrs. G. L. Richardson. To those bereaved ones we of "Pacific Service" extend our deepest sympathy.

Memories of the earliest days of hydro-electric development in northern California have been revived by news of the death of



John Edmund Poingdestre

John Edmund Poingdestre, a pensioner of this company, who passed away at his home in Monterey September 14th, aged 83 years.

He was a native of the Channel Islands, a British possession, born there June 22, 1848. He received his education at

seats of learning in France and Austria. At 30 years of age he came out to California and there pursued various occupations. He invested in farming and mining enterprises and while concerned with a mining venture in Nevada County he made the acquaintance of Eugene de Sabla Jr., who was destined to play an important part in hydro-electric development in north-central California. In 1894 he entered de Sabla's employ in the newly organized Nevada County Power Company, which built the first hydro-electric plant on the South Yuba for the purpose of supplying power to the mines of that region. His position was bookkeeper and accountant in the company's Nevada City office. From there he was transferred to Grass Valley as manager and held that position until 1905, when he was sent to take charge of the California Gas & Electric Corporation's business at Redwood City. In 1906, following the merger of that concern in the Pacific Gas and Electric Company, he was transferred to Marysville as manager of that section of the "Pacific Service" territory. There he remained until January 1, 1918, when he was retired on a pension.

At the age of 41 he espoused Miss Anne Cox, of San Jose. Upon his retirement he moved with his wife to a pleasant home in Monterey, and there he passed the balance of his days. He was of a kindly disposition and was a general favorite. To his devoted wife, who survives him, we offer our most sincere condolence.

# PACIFIC GAS AND ELECTRIC COMPANY

A CALIFORNIA CORPORATION

Managed by Californians

Operated by Californians

THE CONSOLIDATED "PACIFIC SERVICE" SYSTEM REPRESENTS (as of June 30, 1931)

13,830 employed in all departments.

\$650,000,000 capital invested in gas, electricity, street railway, steam and water plants.

85,000 square miles of territory in which it operates— an area greater than that of England and Wales.

85,000 stockholders.

45 counties of the State in which it transacts business.

1,246,600 consumers served with gas, electricity, water and steam.

2,750,000 people in 45 counties, which is approximately 50 per cent of the State population.

618 cities and towns in which it supplies service directly and through other companies.

\$27,979,000 annual wages paid employees, year ending June 30, 1931.

\$9,345,000 taxes, Federal, State, county and local, year ending June 30, 1931.

1,177,807 horsepower developed in 50 electric water-power plants.

510,188 horsepower developed in 15 electric steam plants.

1,687,995 total horsepower developed in 65 plants.

3,320,667,000 kw. hours sold, year ending June 30, 1931. This is equivalent to the effort of 11,069,000 men.

24,237,752,000 cubic feet of gas sold, year ending June 30, 1931.

33,397 miles of electric transmission and distribution lines. Greater than the distance around the earth.

6,931 miles of mains used in distributing gas. Greater than the distance between San Francisco and Oslo, Norway.

955 miles of mains and ditches used in distributing power.

1,370 miles of track of railway supplied with electric power.

616,395,950,000 gallons of water storage capacity of 115 lakes and reservoirs. This amount of water would supply the City of San Francisco at the present rate of consumption for approximately 34 years.

215,121 acres of land owned in California.

572 parcels of property owned in cities and towns.

577,284 horsepower in agricultural motors depending on "Pacific Service."

1,064,083 horsepower in mining, electric railways, manufacturing and other motors depending on "Pacific Service."

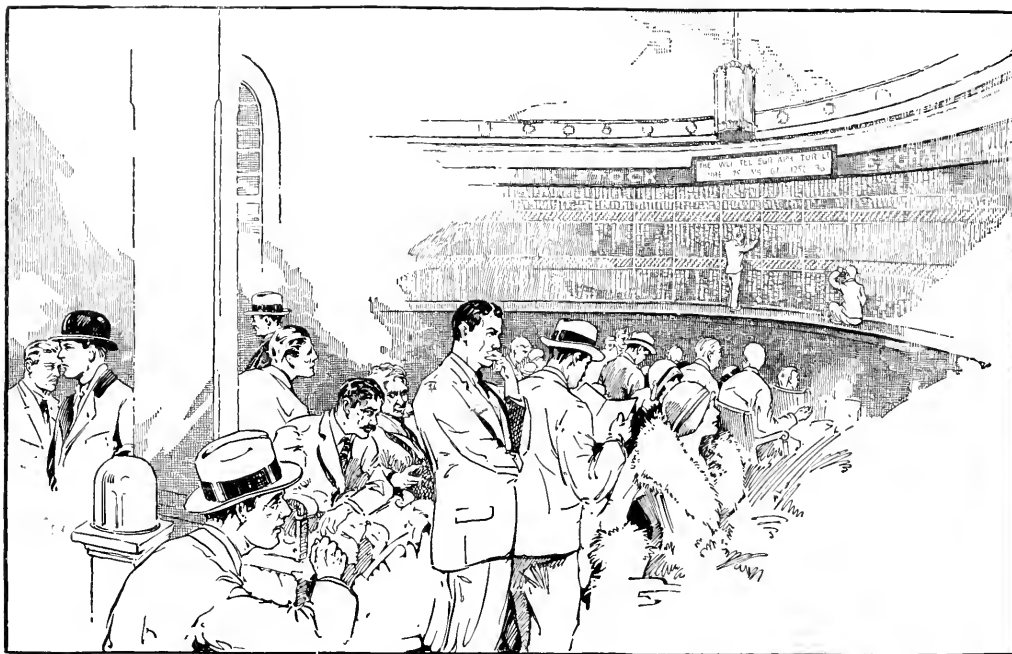
3,597,026 horsepower connected to system.

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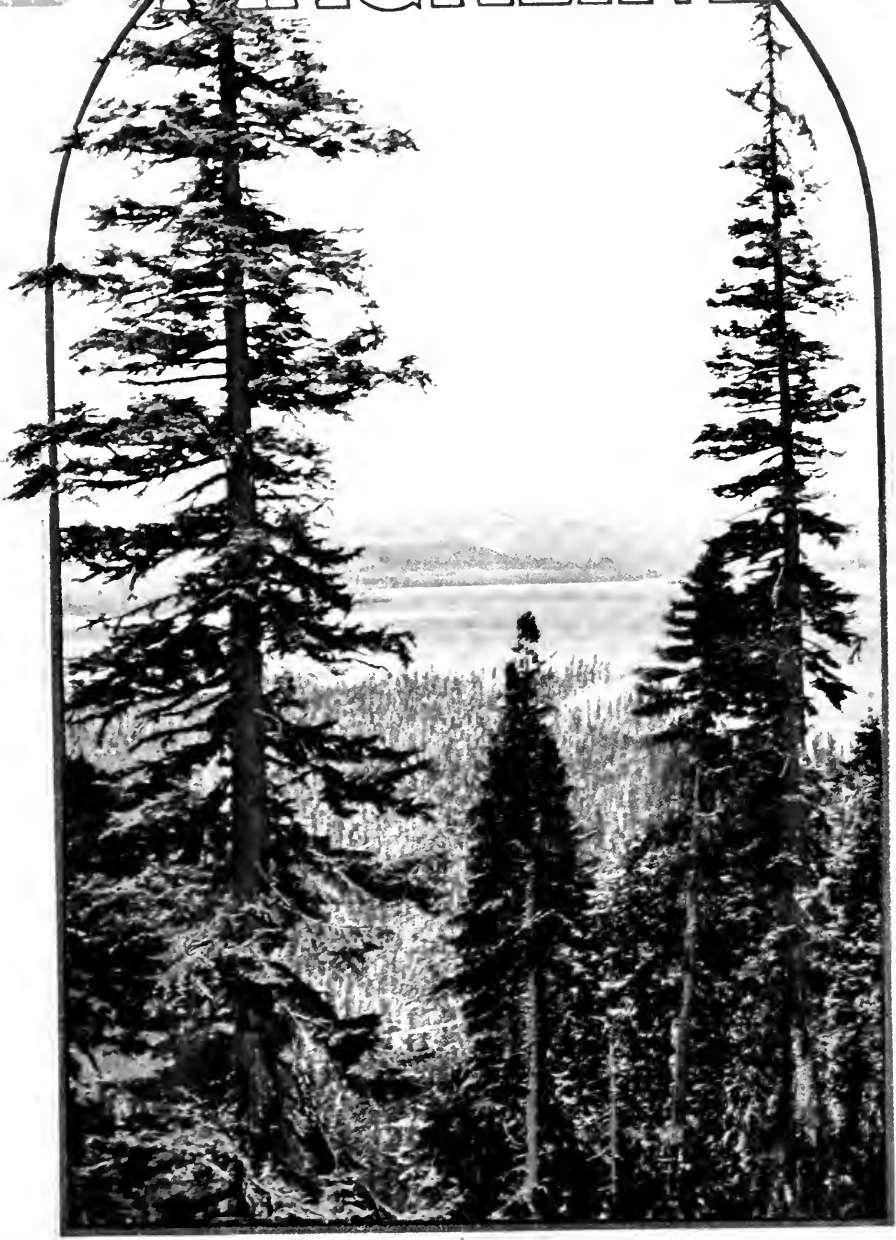
In good times and bad, in boom and depression, this Company's First Preferred Stock has paid dividends with punctilious regularity. The fifty-four thousand holders of this high-grade security have never had occasion to entertain the slightest uneasiness as to the safety of their investment.

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Circulars descriptive of this investment issue will be mailed upon request.

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# PACIFIC SERVICE MAGAZINE



VIEW OF MT. LASSEN FROM LAKE ALMANOR

Vol  
18

JANUARY 1932

No  
7

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# Pacific Service Magazine

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Mt. Lassen in eruption. Picture taken June 14, 1914.

## "Pacific Service" in Lassen County— Electricity Transmitted to Bieber

By W. T. HANNUM, *Assistant to Engineer of Line Construction*

"Pacific Service" entered new territory recently when the Lassen County Supervisors granted a franchise allowing the Mt. Shasta Power Corporation, a subsidiary of Pacific Gas and Electric Company, to distribute electricity in that county. The immediate purpose of the franchise was to permit the construction of a power line from McArthur, in Fall River Valley, Shasta County, to Bieber, which is located in Big Valley in the extreme northwestern corner of Lassen County, and which was until recently a quiet town of less than 200 population. It is 100 miles northeast of Redding on the state highway to Alturas, which is also a route to the Yellowstone National Park and, in early days, was an important immigrant route into California.

Big Valley, and Bieber in particular have recently been featured in the headlines of newspapers all over the country, because Bieber is the junction point of the new Great Northern and Western Pacific Railroad lines, which form a new link in the transcontinental network. These lines will undoubtedly be a great boon to the industrial and agricultural progress of this section of the state, which has hitherto lacked adequate transportation facilities. The small town has already been transformed into a bustling community, and a new town called Nubieber is located adjacent to the railroad terminals. These developments brought forth sufficient present and potential demand for electric power, so that service could profitably be extended.



View of Pit River No. 1 power plant. Fall River Valley in the distance.

The nearest source of power is the 94,000-horsepower Pit No. 1 Power House in Shasta County, from which an 11,000-volt distribution line already extended seven miles through the Fall River Valley as far as the town of McArthur. Bieber is nineteen miles northeast of McArthur by road, but a slightly greater length

of line was constructed in order to pick up as much load as possible along the way, and to secure suitable rights of way over private property.

The route chosen leads through the small hamlet of Pittville, located on the Pit River at the Shasta-Lassen county line. A short distance beyond, a branch line five miles long was built up the fertile valley of the Pit River, which turns south to swing around the mountain ridge dividing Fall River Valley from Big Valley. From Pittville, the main line traverses four miles of lava beds, and then crosses the mountain through four miles of heavy timber, at an elevation exceeding 5,000 feet. In Big Valley, the state highway



Pit River No. 1, intake on Fall River. Valley in background.

is followed into Nubieber. Here a detour from the direct route to Bieber is made to the north, to reach the new mill of the Klamath Moulding Company, where a townsite is laid out for West Bieber. Other short branch lines and the distribution system in Bieber bring the total length of new line to slightly over 30 miles.

In order to provide for growth of power demand in Big Valley, and possible future extension to the northeast, the main line from McArthur to Nubieber, 17½ miles in length, is insulated for 22,000 volts and constructed for ultimate 60,000-volt operation, with sufficient space on the poles for a distribution circuit in Fall River Valley.

During construction, 213 k.w. of transformer capacity was placed on the line in Fall River Valley for agricultural pumping, and 50 k.w. for domestic uses. In Nubieber, transformers totaling 115 k.w. were installed to take care of industrial, commercial, and domestic load, including only the initial requirements of the Great Northern and Western Pa-



Looking up Fall River in the direction of Mt. Shasta.

cific Railroad terminal and the Union Ice Company's refrigerating plant, which were still under construction. New buildings for residences and stores were also being started almost daily. The Klamath Moulding Company had commenced building their sawmill at West Bieber, and three 75 k.w. transformers were connected to the line for their motors.

The balance of the load ready for service was in the town of Bieber and included both commercial and domestic lighting, cooking, water heating and refrigerating, a few commercial and industrial motors, and 5 k.w. in street lighting, chiefly in 500-watt units.

The total of 769½ k.w. in transformer capacity on the line will serve approximately 150 new consumers, and, while sufficient to provide for additional consumers in the towns, will have to be increased to take care of additional pumping expected in Fall River Valley, and larger motor load which will undoubtedly be required by the railroads and the ice plant.

The construction of the line presented no exceptional difficulties. While surveys were being made and rights of way were being secured, a study was made to determine the



Pit River at Pittville, near Shasta-Lassen county line.

most economical method of delivering material to the line. According to preliminary estimates, seven carloads of poles and four carloads of other material would be required. The following alternatives were considered:

(1) Hauling by truck from the central warehouse in Oakland, a distance of 325 miles, except poles which were in the company's pole-treating plant in Redding; (2) Shipping by rail to Redding, and hauling by truck to the line; (3) Shipping to Pondosa or Lookout Junction by the McCloud River Railroad. It was decided to ship by rail to Lookout Junction, which is twelve miles north of Bieber, and to distribute the material from that point by company trucks. This turned out to be by far the best routing because, by the time the material arrived at Lookout Junction, the Great Northern tracks were laid almost to

Bieber, and after two cars of poles were unloaded arrangements were made to have the other cars delivered at Nubieber; incidentally, the first freight to arrive there over the new road.

Three 3½-ton heavy duty trucks and two 1½-ton light trucks, loaded with tools, and a tractor, were sent from Davis, which was the headquarters for the Construction Department equipment.

Clearing the timber and



Transmission line crossing from Fall River Valley to Big Valley.

brush from the 30-foot right of way was started first. An area of thirty acres was involved, over half of which was virgin forest. This work was closely followed by a crew engaged in digging pole holes across the mountain and the lava flows, where hand work and blasting were necessary. Distribution of material along the line was begun as soon as it was received. The tractor was utilized to remove logs from the cleared area, and to supplement the trucks in delivering material along the eight miles of line which was not very accessible to them. A combination earth-boring and pole-raising machine, sometimes described as a "pole-planter," dug all the holes in ordinary soil and set nearly all the poles in the line, at a rate varying from twenty to forty per day.

Two and one-half months were required to complete the work with a maximum crew of sixty-five men, about half of whom were residents of the local communities.

Power was first delivered to Bieber on November 9th, just in time to assist in the celebration which was held the next day, marking the movement of the first train between San Francisco and the northwest via the Western Pacific and Great Northern Railroads.

The northeastern portion of California, of which Lassen County forms a part, is noted for its immense stands of virgin timber, chiefly western yellow pine. In spite of the fact that lumbering is the principal industry, these forests have scarcely been touched, because cheap means of transportation for the products have not been available. Second in importance is cattle and sheep raising, which developed on the rich grazing lands found in the numerous large and open valleys lying



Pole line crossing ridge between Fall River Valley and Big Valley.

between the wooded mountain ridges. Agriculture is rapidly coming to the front, however, and bringing with it the dairying industry. Hay and grain are the main crops and large areas are under irrigation.

This region presents many attractions to tourists and sportsmen. The former are drawn by the varied mountain scenery, and many Californians still have the pleasure awaiting them of viewing Mt. Lassen from the north and Mt. Shasta from the east at the same time. On account of the distance from large centers of population, sportsmen find that game is still plentiful. The most interesting animal from their point of view is the Rocky Mountain mule deer, found in California only in the northeastern counties. Ducks, geese and other game birds are abundant, and streams are numerous in which anglers



Pole line on county road between West Bieber and Bieber.

can enjoy themselves to the limit.

Big Valley, with a total area of approximately 245 square miles, is 23 miles long and 20 miles wide, in outline resembling an octopus, with arms reaching out in almost every direction in small valleys. Bieber, principal town, and Nubieber, budding railroad terminal, lie in the southwest side of the valley in Lassen County, and Lookout, lying on the north, and Adin on the east, are located in Modoc County.

Here the dusky Pit River Indians pitched their lodges and eked out a casual existence marred only too frequently by the ruthless raids of their eastern neighbors, the quarrelsome and predatory Modocs. Legend has it that the frequency of these raids, most of which were "wife-stealing expeditions," reduced the Pits to such a continual state of panic that they moved their families to the north side of the valley near a large marsh, into which they might retreat in times of danger, and stationed lookouts with ready signal fires on a knoll commanding a view of the eastern entrance of the valley. From this custom the present town of Lookout, located on a northern knoll, is said to have derived its name.

In later years the Modocs, under the leadership of their famous chief, Captain Jack,



Looking up Market Street, town of Bieber.

were subdued, but not without great difficulty, by United States troops, who followed them into their lava-bed stronghold near Big Valley and almost annihilated them after one of the last and bloodiest Indian wars in the history of the West.

Early settlers in this country turned to cattle-raising for a livelihood, and in a few years some of them accumulated vast herds of grazing stock. Among these were C. W. Clark and his partner, Cox, who became veritable cattle barons with great herds under their brand and several vast ranches in their possession. One of these great ranches, ten thousand acres in extent, is still intact in the heart of the valley, under the ownership of the present C. W. Clark Cattle Company.

In the way of agriculture, crops produced by the early farmers were limited to wheat, oats, barley, alfalfa and such other crops as they could feed to livestock and then drive

the stock on foot to market. This restricting condition, chiefly owing to lack of transportation facilities, has persisted until the present time, when the development of electric service as well as highway and railroad facilities is hailed as ushering in a new era during which this region may come into its own and contribute to the prosperity of the nation from the virgin wealth of its natural resources and their ultimate development.

Of the total area of over 156,800 acres in Big Valley, it has been estimated



Sylvan scene in Lassen County, near Bieber.

that 110,000 acres are suitable for agriculture. The report of an agricultural survey recently made by the Great Northern Railroad states that in the matter of irrigation there are now some 14,000 to 15,000 acres watered by canals or ditches, but it is conceded by all engineers that 25,000 to 30,000 additional acres can be irrigated by pumping. Incidentally, the report calls attention to the fact that Pacific Gas and Electric Company furnishes low-cost power for irrigation in Fall River and notes with satisfaction that our company has extended its transmission system into Big Valley where power is needed to develop irrigation.

Conditions have changed greatly from the days of the first settlers who took up their abode in Big Valley in 1869. Most of this change has come in recent years, and no little part is due to the construction of good roads. A fair mountain road from Susanville, the county seat of Lassen County, passes through the valley on the way to Klamath Falls. The state highway between Redding and Alturas, of course, carries the heaviest traffic. When the Pacific Gas and Electric Company started development of its Pit River power plants, it was an all-day trip to them from Redding; now it is an easy two hours' drive. In the last decade this highway has been so improved both in routing and surfacing, that it



Looking East, down highway, across Big Valley to Nubieber.

can readily be kept open all the year round. Even the snows of this past December, which reached unprecedented depths in some sections of the mountains, failed to close this route, and still further improvements are planned for the near future.

The highway which is now under construction by the Federal Government between Mt. Lassen and Mt. Shasta as a part of its National park to park system passes through Shasta County just a few miles west of Fall River Valley. This road will further increase the accessibility of this region, and will bring a larger number of tourists and home-seekers, some of whom will doubtless remain to take advantage of the opportunities to share in the growth of agriculture, business and industry.

The California Railroad Commission, following formal hearing at Susanville, county seat of Lassen in January, has granted our company a certificate of public convenience and necessity to exercise all rights obtained under the franchise granted by the Lassen County Board of Supervisors. Under the franchise and certificate so obtained, the company will maintain and operate this new extension of its electric system and future additions.



Nubieber, recently constructed town on state highway.

# Lassen Volcanic National Park— Wonderland of Scenic Interest

The volcanic region of northeastern California was brought into special prominence last July when Lassen Volcanic National Park was formally dedicated to the people of the nation.

This latest addition to the national parks of California is situated in a section of the State which marks the junction of the southern end of the Cascade Mountains with the Sierra Nevada. It was created by Act of Congress approved August 9, 1916, at the conclusion of a long and strenuous campaign waged in its behalf by the late Congressman John E. Raker. Ten years previous to that, in 1906, two cones considered to be the best examples of recent volcanic action in this country, Lassen Peak and Cinder Cone, were set aside by President Taft as the Lassen Peak and Cinder Cone National Monuments. These, of course, formed the nucleus of the new national reservation and are its central features of interest, supplemented by



Park headquarters station at Mineral.

other notable cones and a number of hot springs and other geological phenomena.

The park is 163 square miles in area and measures 12 by 17½ miles at its greatest dimension. Pacific Gas and Electric Company played a part in its completion, for a small section at the northwestern extremity of the park was, until a year ago, in "Pacific Service" territory. This consisted of 280 acres of land and two natural lakes, Manzanita Lake and Mud Lake, the former 40 and the latter 12 acres in surface area. They formed part of the water storage system of the Northern California Power Company whose properties were acquired by Pacific Gas and Electric Company in 1919. Our company disposed of the tract mentioned to the United States Government in February, 1931, the government paying therefor one-half of the agreed upon purchase price, while the balance was donated by our company to the cause, thus relieving the local au-



Raker Memorial Gate at park entrance.

thorities of the necessity of raising this amount by popular subscription.

The principal feature of attraction is, of course, Lassen Peak, which rises to a height of 10,453 feet above sea level and is the only recently active volcano in the United States, exclusive of Alaska and Hawaii. For a period of about 200 years the mountain was quiescent, until, in the spring of 1914, started a series of eruptions covering a period of about 19 months. On May 22, 1915, occurred the greatest eruption of the series. A cloud of smoke burst upward to a height of four miles. Blasts of superheated gas swept down Lost Creek and Hat Creek valleys at an estimated velocity of 400 miles an hour. For a radius of ten miles it withered every living thing in its path. Forest areas were scorched to cinder,



View of a part of Bumpass Hell

snow fields melted and the waters ripped down the steep slope of the mountain. As the flow continued it increased in volume and absorbed loose surface material until it became a thick mud in which were mingled huge boulders and explosive debris. This path of destruction is known today as the Devastated Area.

An interesting illustration of the terrific force of the mud flow is found in what is now called the Hot Rock. This great boulder was carried from the belching crater of the mountain to its present resting place on Lost Creek nearly three miles distant. The rock was so hot that the water at its base sizzled for some forty hours after it found its resting place.

Cinder Cone, the other volcanic peak referred to, lies at some distance to the eastward of Lassen at the northeast extremity of the park. Its elevation is 6,919 feet above sea level. It rises from a glaciated meadow, a cone of volcanic sand 663 feet high and slightly over half a mile in diameter at its base. From its crater layers of sand and pumice were once spread over the country around for a distance of about eighty miles in every direction. Its latest lava flow was between 1850 and 1854.

While the two mentioned are the most spectacular and impressive examples of volcanic activity in that region, they are not the only craters to be found within the park. There are at least a dozen others. Two of



Boiling Lake Springs.

them, Mt. Harkness and Prospect Peak, serve as locations for fire lookouts. At Harkness a seismological station has been established.

A companion peak to Lassen is called "Broke-off Mountain," so called because it has the appearance of having had its entire crest torn off by some terrific upheaval. It is the oldest as well as the largest crater of them all and stands second to Lassen in height, 9,400 feet above sea level.

Chaos Crags and Chaos Jumbles, smaller mountains formed of rough, broken lava, are found rising from the slope of Mt. Lassen on the north. They are believed to have been formed within the last 200 years, partly as the result of volcanic explosion unattended by lava flow. They stand about 8,500 feet above sea level.

Evidence that the volcanoes of Lassen are not dead but, rather, are fitfully slumbering is found in the many hot springs within the park area. The largest is Bumpass Hell, where are bubbling mud pots, splashing geysers, queer miniature formations built up

around steam vents and an all-pervading atmosphere of weird, intangible force. The area lies south of Mt. Lassen and is about 80 acres in extent. It is of a creamy-white saline and sulphur-encrusted, heat-baked earth. There is no great volume of sound, rather a constant gurgling of boiling mud pots and a hissing of steam vents.

A similar area, lying eastward of Bumpass Hell, has been named the Devil's Kitchen. Still further eastward, on the edge of Warner Valley, is found Boiling Lake, a great hot spring nearly 2,000 yards in circumference.



Lake Helen, at the foot of Lassen Peak.



Mt. Lassen from Loop Highway, crossing the Devastated Area.

Another phenomenon of the kind is found in the Sulphur Works area, near the entrance of the Loop Highway in the southwest corner of the park.

Within the boundary of the park are over forty lakes. Fed by the melting snows, their waters are as giant mirrors reflecting the mountains and forest around. On the Loop Highway, near the summit, is Emerald Lake, green and as richly colored as the gem from which it takes its name. Above it lies Lake Helen, at the foot of Lassen Peak. The park has four large lakes, Juniper, Manzanita, Snag and Butte lakes.

Nearly every valley of the park carries a mountain stream fed by melting snows and springs. Many of them pitch headlong over mountain cliffs. Among the most beautiful of the falls are two on King's Creek and one at the point where Bumpass Creek joins Mill Creek in Mill Creek canyon.

There is excellent fishing everywhere. Mr. G. R. Milford, our company's manager of



Chaos Crags and Chaos Jumbles.

Shasta Division, who knows every inch of that country, states that before the big eruption in 1915 Manzanita Lake contained a species of trout not known to exist anywhere else; but the outpouring of ashes from the mountain was carried by Manzanita Creek into the lake and the fish died. Subsequently, when the lake was cleared, it was restocked by the California Fish and Game Commission from its hatchery at Mt. Shasta City, formerly known as Sisson.

The park may be reached from either Redding, by way of Viola, or Red Bluff, by way of Mineral, on the west, or from Susanville, by way of Lake Almanor, on the east. The

Lassen Park Loop Highway to which reference has been made and which was completed in time for the opening ceremonies, enters the park at its southwest portal, situated forty-eight miles from Red Bluff and about eight miles from Mineral, and makes a complete circle of Mt. Lassen, taking in most of the park wonders en route, terminating at the northwest portal beyond Manzanita Lake, from which a three-mile stretch of road lands the traveler at Viola, forty-three miles from Redding on the public highway running to Hat Creek valley



Lassen Peak from Mud Lake.

and the Pit River region. The Loop Highway is thirty miles in length and is of standard modern construction, with a 26-foot roadbed and surfaced with crushed rock. Although the park was created in 1906, no actual road program was attempted until 1926, when construction activities were started. In addition to the highway, many of the old trails have been reconstructed into standard paths. The two major trails of the area are the Lassen Peak trail, constructed last year, and the Bumpass Hell trail, graded in 1928. Mr. H. H. Campbell, an employee of Shasta Division, recently enjoyed a trip over the highway. He took some pictures en route, some of which illustrate this article. Mr. Campbell gives the following outline of his trip:

"This new highway is paved the entire distance of approximately thirty miles. At the southwest boundary of the park, some eight miles from Mineral, we pass through the Raker Memorial Gate, built as a memorial to Congressman John Raker, who sponsored Lassen Volcanic Park in Congress. One-half mile inside the park we arrive at the Sulphur Works checking station, where we stop for our permit and to have our firearms sealed, if any. About one-half mile further on up the highway we stop at the Sulphur Works to inspect the steam vents. Here we get our first real smell of sulphur. Our next stop is at the soda spring. We find the water here very nearly of the same flavor as the carbonated water to be had at our local soda fountains. As we circle on up the highway we see Diamond Peak. This peak is formed of black lava and rises to a height of 7,969 feet. To the south we look back over Mill Creek Canyon and Little Hot Springs Valley many hundreds of feet below us. Upon looking to the west we see the flat face of Broke-off Mountain and the tiny glass-enclosed lookout station perched upon its highest point, 9,232 feet above sea level.

"Our next stop is at Emerald Lake. Here we look into the depths through the transparent emerald waters and see thousands of trout. Bumpass Hell is reached by an easy trail of about one and one-half miles and is well worth the time and energy. As we reach the end of the trail and look down into Bumpass Hell we see a small valley literally filled with steam, hot water and bubbling mud. Our next stop is at Lake Helen, where we get our first close-up view of Lassen Peak.

"We next stop at the foot of the Lassen

Peak trail where we park our car while we make the trip up the peak. The new trail was built by the Park Service in 1931 and is a great improvement over the old one. The climb is not an exhausting one as the trail is over a 15 per cent raise. On reaching the top we look down into the crater and wonder at the power of nature to create the terrific heat necessary to liquefy this tremendous volume of lava. The view from the top of Lassen Peak must be seen to be appreciated. As we look out over the park we see dozens of lakes dotting the green carpet. Far to the east we see a tiny ant hill and are told that is Cinder Cone. Faintly in the distant southeast we see the sparkle of the waters of Lake Almanor. Looking back the way we came we see many miles of the Loop Highway winding as a tiny ribbon through the hills and valleys of the park.

"Next we proceed to Upper Kings Creek Meadows, scene of the dedication ceremonies on July 25th. On the way we cross the summit of the Loop Highway. The altitude is 8,512 feet.

"We pass Summit Lake and campground, where good fishing is to be had. Two miles farther on we reach the Devastated Area and must stop to gaze and wonder. We next stop to inspect the famous Hot Rock carried down from the peak by the mud flow and which retained its heat for many days. As we proceed to the Loomis Memorial Museum we are offered a magnificent view of Chaos Crags and Chaos Jumbles. These are small mountains of rough, broken lava.

"The Loomis Memorial Museum, near the northwest portal of the park, was a gift of Mr. B. F. Loomis as a memorial to his daughter. We find in there the entire story of the Lassen Peak eruptions told in pictures.

"After visiting the seismograph station we pass between Manzanita and Reflection Lakes to the Manzanita Lake checking station and out of the park."

The park dedication ceremonies occupied two days, July 24th and 25th, and were largely attended. The program included talks by the Secretary of the Interior, Hon. Raymond L. Wilbur, Governor James Rolph and others of prominence. The feature of spectacular interest was a night fireworks display from the top of Lassen Peak, designed by Mr. Frank Hill, of the Pacific Fireworks Company, and announced as the largest pyrotechnic display ever attempted. It was directed by our Mr. G. R. Milford.

# Electric Tabulating Machine

## Method for Consumer Accounts

By H. T. TERRY, Auditor Division Accounts

*The process by which a great corporation like Pacific Gas and Electric Company, with its million and a quarter customers for gas, electricity, water and steam service, prepares and sends out its monthly bills and, at the same time, keeps record of the status of each account is detailed in the subjoined article. We venture to think it will be of interest to our readers, revealing, as it does, the intricate details of an up-to-date plan of accounting and billing that is an important feature of "Pacific Service" organization.—EDITOR.*

Prior to 1924, the so-called Boston Ledger Plan was used throughout the entire "Pacific Service" system for billing and bookkeeping of consumers' accounts for all services. This plan, still in use in the smaller divisions, was employed in East Bay Division until the end of 1924 and in San Francisco Division until August, 1928, at which times machine systems were installed in these divisions. In East Bay Division a Bookkeeping and Billing Machine Plan was adopted and in San Francisco Division the Tabulating Machine Billing and Ledger Card Plan.

Under the Boston Ledger Plan, it is possible to handle from 2,500 to 3,000 meters per clerk. Under the Machine Plan in East Bay Division approximately 3,500 meters are handled per clerk, and under the Tabulating Machine Plan in the Consumers' Records Department, comprising San Francisco, San Jose and North Bay Divisions, approximately 4,500 meters are handled per clerk.

The Tabulating Machine Billing Plan was instituted in August, 1928, and in the latter part of 1929 the North Bay and San Jose Divisions were consolidated with the San Francisco Division accounts and placed under the jurisdiction of the Head Office Consumers' Records Department, in San Francisco. The Consumers' Records Department handles all regular domestic and commercial gas and electric consumer accounts, meter deposits, all merchandise accounts and main line extension deposits. All power accounts and special commercial lighting accounts are handled by the Accounts Receivable Bureau of the General Auditing Department, which bureau also handles the power accounts of East Bay Division.

At the present time the Consumers' Records Department is handling about 550,000

gas and electric meters, represented by approximately 360,000 bills each month. To handle this volume of work, it is necessary to have an even flow of operations and, to accomplish this, the total number of meters were divided into 24 serials, each serial consisting of approximately 23,000 gas and electric meters. A serial represents a day's work for meter readers, collectors and office clerks, alike.

In the Consumers' Records Department a number of forms are used, the two outstanding being the revenue and ledger tabulating card and the consumer's bill, both of which are illustrated herein. At this time, it might be well to explain the various uses made of the revenue and ledger tabulating card. After being addressographed and punched, the cards are used to obtain the revenue accounting and control; they are also used in printing the consumer's bill. After these operations, the cards become the ledger account and remain in the ledger file until paid, when they are removed to a paid-card file. At next billing date, these paid cards are listed on a register sheet whereon are recorded the consumer's account number, the present and prior meter readings, the date of readings, the quantity consumed, the charges for both gas and electricity and the date of payment. The cards are kept for a period of two or three years and then destroyed, the register sheets being retained permanently.

Attention is next directed to the consumer's bill form. It will be noted that it is not merely a bill but a statement in detail of the consumer's unpaid account as well. Under the Tabulating Machine Billing Plan, the bill shows a charge for gas, a charge for electricity and a complete detail of any unpaid items in the account. This information is

PACIFIC GAS AND ELECTRIC COMPANY P. G. & E.

R. A. CONSUMER  
2839 GREENWICH  
X10  
MAIL 333 GRANT AVE  
GE  
168777 6250 E250 495

CODE	READING DATE	METER READING PRESENT	CONSUMED FROM	STATEMENT OF ACCOUNT TO	DISPOSITION	AMOUNT
82	Oct 4	8456	8353	93	G	8.08
82	Oct 4	244	204	40	E	2.20
82	Oct 4	8544	8446	98	G	8.45
82	Nov 3	204	244	40	E	2.20
82	Nov 3	8664	8544	120	G	10.10
82	Dec 3	338	284	54	E	2.83
						33.86*

ELECTRIC METER COMPANY

PACIFIC GAS AND ELECTRIC COMPANY P. G. & E.

R. A. CONSUMER  
2839 GREENWICH  
X10  
MAIL 333 GRANT AVE  
GE  
168777 6250 E250 495

CODE	READING DATE	METER READING PRESENT	CONSUMED FROM	STATEMENT OF ACCOUNT TO	DISPOSITION	AMOUNT
	Sep 3			3	Gas	9.08
	Oct 4			4	Elec	2.20
	Nov 3			3	Gas	8.45
	Oct 4			4	Elec	2.20
	Nov 3			3	Gas	10.10
	Dec 3			3	Elec	2.83
						33.86*

GAS IN HUNDRED CU FT  
ELECTRIC IN KW HRS

OFFICE COPY  
TO BE RETURNED TO OFFICE

RECEIVED PAYMENT

DATE PAID

AMOUNT PAYABLE UPON  
PRESENTATION OF THIS BILL

COLLECTOR

DATE PAID

COLLECTOR'S USE

R. A. CONSUMER

2839 GREENWICH

X10

MAIL 333 GRANT AVE

GE

168777 6250 E250 495

348

X10

GE

168777 6250 E250 495

DEC-31

CARD

CON

SUM

PREC

READINGS

CON

SUM

PREC

READINGS

CON

SUM

PREC

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The upper illustration shows the form of bill prepared on Electric Tabulating Billing Machine from punched card opposite.

The punched card shown at left, when run through the Tabulating Billing Machine automatically transfers the figures to the bill shown above.

PACIFIC GAS AND ELECTRIC COMPANY

CO

PEE

62781

168777 6250 E250 495

168777 6250 E250 495

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168777 6250 E250 495

168777 6250 E250 495

168777 6250 E250 495

invaluable, for the reason that it allows the clerk in the district office to reconstruct the entire account from the current month's bill alone. Such reconstruction is often necessary at the request of consumers, and the information making it possible is secured with very little expense and a very slight delay in the preparation of the bill.

Under the Boston Ledger Plan and other Machine Plans, the bill rendered to the consumer shows a charge for gas, a charge for electricity and one balance item, representing all the unpaid items of the account. The detail of the unpaid balance, which is shown on the Tabulating Machine bill, could not be placed on the Machine bill or on the Boston Ledger bill without prohibitive cost and excessive delay in rendition of the account.

*Establishment of and Discontinuance of Service.* The prospective consumer makes application at our office, or by telephone, for gas and/or electric service, at which time a form, known as the "Set and Out Tag," is issued in triplicate, one copy for the gas service, one copy for the electric service and one copy for the office file. If the consumer is unable to establish credit, he is required to make a deposit or furnish a guarantor for the account. The tags are then forwarded to the Operating Department, where necessary arrangements are made establishing service to the consumer. The present reading of the

meter is noted on the tags, and the tags are then forwarded to the Consumers' Records Department Ledger Section, where they are entered in the meter books. This entry covers the name, address, account, route, class of service, effective schedule and revenue accounting number.

When a consumer desires service discontinued, the same procedure is used as above and the tags, when received in the Ledger Section, are entered in the meter books, at which time the closing bill covering the period from last reading to date of closing is rendered to the consumer. Closing bills are rendered and delivered to the Collection Department at 4:30 P. M. each day for all tags received from the Operating Department that morning.

We will now explain in detail the various operations necessary in preparing, each month, the 360,000 bills covering the consumption recorded by the 550,000 gas and electric meters.

*Addressograph Section.* In this section there are approximately 360,000 stencils for gas and electric consumers. These stencils show name, address, route and account numbers, mailing address where it differs from the service address and, also, deposit and guaranty data where credit has not previously been established.

The stencils are placed in a special addressograph bill-printing machine, which makes an imprint from the stencil in three positions and prints both sides of the bill at the same time, operating at a speed of approximately 2,500 bills an hour. These stencils are then placed in another machine, where approximately 360,000 tabulating cards are addressographed to show the same consumer information as that appearing on the bill. These cards become, in turn,



Addressograph Section. Here stencils are kept and bills and cards addressed.

the basis of the bill, the basis of the control and reports, and the ledger.

The day before meters are to be read for each serial, the meter books are received from the Ledger Section and compared with the addressograph stencil; the stencils are corrected to agree with the meter books. This comparison and correction are necessary for the reason that the tags, changing the consumer status of the accounts, do not pass through the Addressograph Section.

The Meter Reading Department then reads the meters and records, in the meter books, the reading of each meter, and subtracts from same the previous reading; the difference representing the consumption of gas and electricity for the period. The books are then sent to the Ledger Section, where any irregularities are checked and then forwarded to the Key Punch Section.

**Key Punch Section.** In this section there are seven electric key punch machines, three electric reproducing key punch machines and one electric check tabulator. The electric key punches are used for recording the meter readings and consumption on the tabulating cards from the meter books. The electric reproducing key punches are used in making the cards for the subsequent month from the cards of the current month; this operation is entirely automatic and reproduces all information on the cards of the current month, with the exception of the subsequent month's meter readings, consumption and charge. The electric check tabulator is a special machine used for the purpose of verifying the amount of the consumption. The machine makes this check by adding the amount of the consumption to the meter reading for the prior month; if the sum does not equal the meter reading for the current month the card



Key Punch Section, where cards are punched.

is automatically ejected.

As the meter books are received from the Ledger Section, the corresponding tabulating cards, which were reproduced from the cards of the prior month, are given to the electric key punch machine operators, who then record on the cards the current month's meter readings and consumption, as shown by meter books, and the charge in case of special billing. The cards are then passed to the electric check tabulator, a machine operating at a speed of 150 cards a minute, where the accuracy of the punching and subtractions is proven; after which, they are passed to the Compare Section.

**Compare Section.** This section receives the bill forms for the current month and cards for the subsequent month from the Addressograph Section, and the cards for the current month from the Key Punch Section, and proceeds to check the three. Here are checked the cards for commencing bills, meter change billing, and general accuracy of the two sets of cards and the bills. On completion of this check, the two sets of cards are returned to the Key Punch Section, where the cards of the subsequent month are then reproduced. This operation transfers to the cards for the subsequent month the greater part of the information on the cards for the current month. After reproduction, the cards for the subsequent month are sent to the re-

produced card file and cards for the current month are sent to the Machine Section.

*Machine Section.* In this section there are five tabulating sorting machines. These machines automatically sort the cards into any order desired, at a speed of 400 cards a minute. There are four tabulating printing machines which will print and list any information which has previously been punched on the cards, the listing being done at a speed of 80 cards a minute; and where totals only are desired they may be had at a speed of 150 cards a minute.

There are, also, two gang punch machines for use where the same information is desired to be punched on a quantity of cards; the machine is set and cards are punched at a speed of 90 cards a minute.

In this section the cards are sorted by tabulating sorting machines into numerical or-

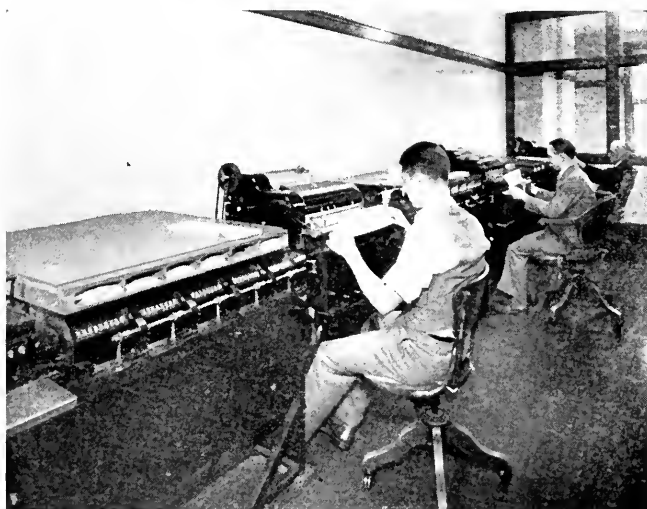


Machine Section, showing tabulating machines.

der of consumption, and the amount of the charge corresponding to the amount of the consumption is then automatically punched on all cards having the same consumption by means of the electric gang punch. When all cards have been gangpunched, they are again sorted into rate schedule order and the amount of charge proven by computing the total consumption at each rate. The cards are then sorted into revenue segregation and

route number and are tabulated in this order, and master control cards are punched for total of each route and revenue segregation. This section, also, punches master control cards for daily cash and other sundry debit and credit items. The control cards are passed through the tabulating machines and a printed detail is obtained, which is forwarded to the Control Section, where each route is balanced before current bills are printed.

The cards are now in route order, and preparatory to billing there must be included with the cards



Billing Section, where bills are prepared on the tabulating machines.

for each route all unpaid balance cards. The unpaid balance cards are received from the Ledger Section and are sorted into month order; they are then sorted, with the cards for the current month's revenue, into consumer account order, after which they are forwarded to the Billing Section.

**Billing Section.** There are three tabulating billing machines which print the pre-addressographed bills from the punched tabulating cards at a speed of 1000 bills an hour. Before placing the tabulating cards and the addressographed bills in the tabulating billing machine they are inspected to see that no accounts are included for billing that should not be, and that the tabulating cards and the bills are in proper order.

It is the duty of the machine operators to watch carefully for any machine errors that might be made and, also, to see that the cards are being printed on the correct bills. This is ascertained by visual comparison (as the bills are being printed) of the account number as addressographed on the bill, with the account number as printed on the bill from the cards. The cards are then sent to the Ledger Section, and the meter books and bills are forwarded to the district offices for delivery of bills to the consumers.

**Ledger Section.** In this section, the clerks receive the meter books from the meter readers, and before forwarding to the Key Punch Section each book must be reviewed to ascertain whether or not there are any meters which, for some reason or other, are improperly recording. This is determined by reviewing the account for the past three or four months, and where any unusual variation in the consumption is noted, the Meter Reading Department is requested to secure another reading or, if necessary, to have meter tested for accuracy.



Ledger Section, where all accounts are kept.

The books are then forwarded to the Key Punch Section for preparation of the tabulating cards for the current month, and are subsequently returned to the Ledger Section, or the District Offices, where they remain until next reading date, as all transactions relating to any change in a consumer's service must be recorded in the meter books, and the "Set and Out Tag" form, which is issued for all such changes, is forwarded to the Ledger Section of the Consumers' Records Department, or to the District Office, by the Operating Department as soon as such change has been made, and recorded in the meter books. After tags have been so recorded, they are forwarded to the Tag Filing Section, where they are permanently filed in route and account order.

As the tabulating cards are received from the Billing Section, they are filed in tubs (steel desks) in route and account order. There are two sections to each route, one section comprising the active accounts, and the other section comprising the closed accounts. The cards representing the active accounts are filed in tubs daily, after being billed. The tabulating cards comprising the closed accounts and representing the amount due from consumer at time service is discontinued are filed in this section daily; after closing bills are rendered, the cards remain therein until such time as the accounts are either paid or

written off as uncollectible.

The clerks in the Ledger Section are responsible for keeping the cards in proper order and, at billing date, removing such unpaid cards by routes and forwarding to the Machine Section. Also, from time to time, it is necessary for these clerks to prepare statement of accounts for various consumers, due to high bill complaints, possible misapplied credits, etc. All adjustments to consumers' accounts covering fast and slow meters are computed in this section.

In addition to the ledger records for the gas and electric accounts, this section also maintains the ledger record of meter deposits and merchandise accounts, the respective classes of accounts being separated and handled by sub-sections; i. e., merchandise section and meter deposit section. The merchandise accounts are handled similarly to the gas and electric accounts.

*Cash Posting Crew.* Each day, at 5:30 P. M., the Collection Department delivers to the Cash Posting Crew, in bundles, all col-

lection stubs of bills paid that day, each bundle consisting of approximately 150 collection stubs. This crew then removes from the tubs all tabulating record cards corresponding to the amounts appearing on the collection stubs. The cards are then balanced by bundles, after which all cards are sorted into route and account order, and a final balance is obtained for all collections of that day. Therefore, as each day's cash is posted that night and all accounts balanced, the accounts at the start of business the following day reflect the actual outstanding at that time.

*Control Section.* This section maintains a cash book for recording daily cash collections and daily bank deposits for all district offices, and is responsible for maintaining an accounting control, by routes, of all charges and credits to consumers' accounts receivable and an over-all control for all accounts handled by the Consumers' Records Department; also, for the preparation of monthly and other statistical reports and the preparation of voucher drafts covering overpayments and for refunds of meter deposits.



# Permanent Gas Appliance Exhibit and Information Bureau in S. F.

By E. B. GRUSSENDORF, San Francisco Division Sales Department

Natural gas has come to San Francisco to stay and it is being adopted by industry at large as the solution of innumerable heating problems. The Pacific Gas and Electric Company is particularly desirous of rendering the communities of the San Francisco Bay area a full and complete service in the utilization of natural gas, and one of the means employed in rendering this service is through the establishment of a Permanent Exhibit and Information Bureau at 31 Beale Street, adjacent to our general office building, where there is on display a representative line of various types of industrial, commercial and domestic equipment, such as torches, heat treating equipment, soft metal pots, burners, cauldrons, cleaning tanks, gas-fired boilers, hotel and restaurant ranges, bake ovens, broilers, as well as auxiliary equipment such as steam pressure regulators, gas pressure regulators, recording devices, pyrometers, controllers, and such domestic appliances as

water heaters, gas furnaces, floor furnaces, etc.

One of the features in connection with this large display of gas equipment is the class "A" commercial lighting installation. In the ceiling have been installed fifty-four Benjamin glass steel reflectors, each equipped with a 300-watt light, giving an average intensity of 20 foot candles. These lights are on ten-foot centers and are sixteen feet above the floor. There are also six Benjamin elliptical angle lights for the purpose of demonstrating lighting for industrials that have a traveling crane. The meeting room is lighted with four 500-watt Guth totally indirect lights. In the large display window at the front of the show room there is installed a system of 20 Wuelker lights arranged in sections and wired so that the lights can be burned alternately or as a single unit. These lights are adjustable so that the rays can be thrown in any direction. The window is also equipped

with four Wuelker spotlights of 500 watts each, which when combined with the twenty 200-watt lamps illuminate the displays in a most effective manner. This window display has a low background which not only permits persons from the street to view the window displays but also gives a view of practically the entire show room.

Boiler settings have been built up in the exhibit to show the



General interior view of Gas Appliance Exhibit.

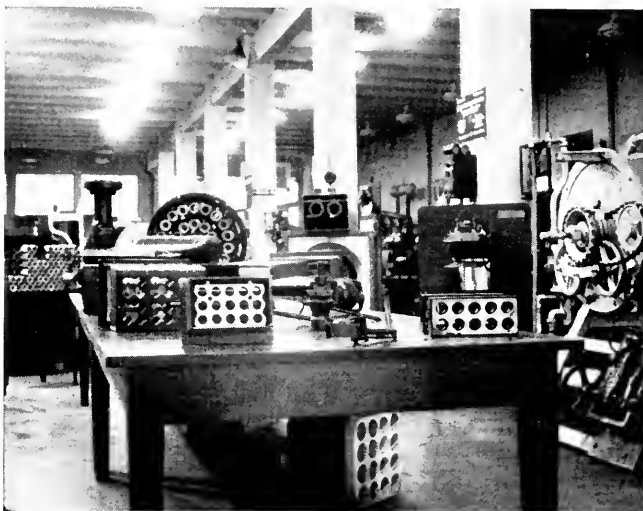
method of installing gas burner equipment. One such setting is equipped with a Webster 3 A X burner and an N. G. E. type A burner. Two surface combination burners, one of them the tunnel type and the other an impact type, are installed in a furnace setting. The brick work for these boiler settings was done by the J & J Fire Brick Construction Company, and serves to exhibit the type of brick work done by this concern.

Large tables are provided on which are displayed a large number of burners, enabling visitors to closely examine all competitive makes. Among the burners exhibited are: Nemec burner for Scotch marine boiler, Nemec low-pressure burner, Staples & Pfeiffer gas burner, Mettler burner, Webster burner, Surface Combustion Co. burner, N. G. E. burner, Sonner hy-power burner, Forney Combustion Engineering Co. burner, Bitgood multiple jet burner, Leahy multiple jet unit, Ironton, Gas-O-Matic, Newman, Franklin, Occidental, McKee, Vulcan.

There is also a Dutch Oven front which is used in demonstrating the operation of a gas burner for the conversion of Dutch ovens.

In the rear of the show room there is an experimental bench for demonstrating torches and small gas appliances. Here appliances and torches can be connected up with gas and air and the appliances operated. An overhead canopy removes the products of combustion.

A section is set aside in the show room for demonstrating several types of boilers equipped with conversion burners. An American ideal sectional boiler is equipped with a Natural Gas Equipment burner, Minneapolis-Honeywell controls. A Birchfeld steam boiler is equipped with a Newman burner, plain diaphragm gas valve, duplex steam pressure regulator and low water cut-off. There is also an American radiator round boiler equipped with a Gas-o-Matic burner, an Ideal sectional boiler equipped with a Surface Combustion heat machine. Two American Radiator Company Arcola coal-burning



Group of natural gas burners on exhibition.

types have been converted to natural gas by the use of Surface Combustion burners and Minneapolis-Honeywell equipment. Included in this section are circulating heaters that have been converted from coal to natural gas.

A warm air coal-burning furnace has been converted to natural gas by the installation of an Occidental conversion burner. This furnace is equipped with two different types of controls, thermostat and push button, which are hooked up and in operation. The boilers, heaters and furnace just described are for the purpose of demonstrating to the public the cleanliness and convenience of modern gas-fired equipment.

Some time ago fifty public school janitors were given a demonstration of these boilers and furnaces. An interesting talk was on the care and operation of gas-fired equipment. Many demonstrations and talks have been given to architects, engineers, building managers, hotel and restaurant owners, sheet metal contractors, bakers, etc. Some of these meetings have had an attendance of as high as 150. Pacific Gas and Electric Company particularly welcomes all those interested to take advantage of the Beale Street exhibit.

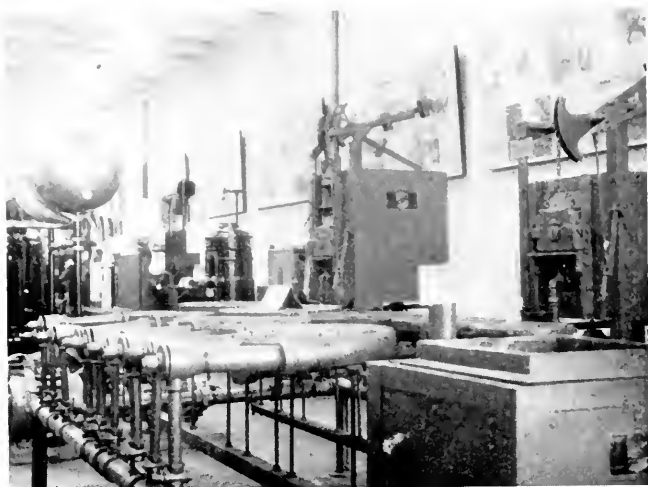
Arranged throughout the show room are attractive boards containing interesting messages regarding the use of natural gas. One of these messages reads as follows: "Looming ever larger on the industrial horizon is the superior flexibility of gas, the modern fuel. Always under perfect control, gas responds

instantly to every demand. For processes requiring exact temperatures and timed variations gas is indispensable. In large and small plants alike gas is adapted to manual or automatic control. To its supreme flexibility add the dependability and economy of gas. Your operations may be simplified when viewed through the eyes of an industrial engineer. A letter or phone call will bring an experienced consultant. No obligations."

Manufacturers of industrial furnaces and heat-treating furnaces have made a very extensive showing of their equipment. For instance, the equipment displayed by James Knapp Company, American Gas Furnace Co. and Surface Combustion Co. includes a standard furnace, carbon steel furnace, high-speed steel furnace, general hardening furnace, carburizing and heat-treating furnace, double chambers high-speed furnace, aluminum-melting furnace, pot furnace, lead-melting furnace, brass-melting furnaces, oil tempering furnace and many small units.

A very extensive display of temperature recorder and controller instruments is made by the leading manufacturers, these exhibits being arranged around the columns in the center of the room and on special panels and include: Bristol automatic control valves (air, solenoid and motor operated), pyrometer and high temperature controller and air-operated temperature controller, Tagliabue time controller, air-operated controller, recording thermometers, recorder controller and steam-operated automatic controller, Mono gas analysis recorder, Foxboro instrument panel of controlling, recording and indicating instruments, Tycos, Wilson-Maeulen and Leeds and Northup instruments, Chubbuck pyrometer for coffee-roasting.

The products of the various manufacturers of gas-burning equipment are brought together in a special exhibit. This display is maintained by our company, for the purpose of demonstrating the great progress made by the various manufacturers, giving the public the opportunity of comparing competitive



Heat-treating furnaces and boilers.

lines and selecting the equipment best suited to particular needs, how to use the consumer's present equipment to better advantage and get the most value and service from his investment. It brings the customer in contact with reputable manufacturers who are in a position to aid and offer suggestions helpful to the prospective purchaser. This assistance is of inestimable value when consideration is given to the fact that one manufacturer of industrial gas equipment makes over 3200 different appliances. Years of research and development were necessary to reach this state of perfection. Manufacturers and the general public should avail themselves of this exhibit and the advantages of its educational features. Whether in the market for equipment or not, it is to their advantage to keep abreast of the times and keep informed on the latest development of gas-fired equipment.

The attendants of this exhibit are in close touch at all times with its exhibitors, and are only too pleased to go over the display with those interested and give helpful information or direct them to representatives and engineers who will give each problem careful consideration. Through the information obtained manufacturers are enabled to improve their business by lessening production cost and reducing spoilage, while improving working conditions of employees and the quality of the product by obtaining the proper equipment.



Thomas W. Taylor



John D. Keller



Matthew Rollinson



Felix Mulvenna



James Harvey



Oscar D. Dewey



Forest R. Cleveland



Michael Margey



Raymond Biven



James Halnan

The "Pacific Service" honor roll. The above portraits are of ten former employees whose long and faithful service has earned them honorable retirement.

## "Pacific Service" Roll of Honor

02

Heading the honor roll of "Pacific Service" are 130 names of men whose long and faithful service to our company has been rewarded by their honorable retirement with provision for their declining years under our company's pension system which underwent complete revision in the fall of 1921.

In preceding issues we presented the portraits of men whose names are upon our company's pension roll, accompanied by their several records. In doing this we were actuated by a desire to make our readers acquainted with these men and their records and to point out what is generally recognized in all up-to-date business enterprises, namely, that long and faithful service shall have its reward.

Opposite this will be found another installment of ten portraits of our company's pensioners. These are:

**John D. Keller.** 77 years of age, having been born February 18, 1855. Entered the service of the Pacific Gas and Electric Company July 19, 1910, and at the time of his retirement was employed in the Supply Department, Emeryville.

**Thomas W. Taylor.** 70 years of age, having been born December 27, 1861. Entered the service of the Pacific Gas and Electric Company June 1, 1910, and at the time of his retirement was employed in San Francisco Division.

**Matthew Rollinson.** 70 years of age, having been born October 16, 1861. Entered the service of the Pacific Gas and Electric Company August 25, 1909, and at the time of his retirement was employed in San Jose Division.

**James Harvey.** 70 years of age, having been born April 2, 1861. Entered the service of the Pacific Gas and Electric Company June 27, 1912, and at the time of his retirement was employed in East Bay Division.

**Felix Mulvenna.** 69 years of age, having been born July 4, 1862. Entered the service of the San Francisco Gas Light Company in October, 1889, and at the time of his retirement was employed in San Francisco Division.

**Oscar D. Dewey.** 67 years of age, having been born January 17, 1865. Entered the service of the San Jose Light and Power Company in December, 1897, and at the time of his retirement was employed in San Jose Division.

**Michael Margey.** 69 years of age, having been born March 15, 1862. Entered the service of the Pacific Gas and Electric Company August 1, 1915, and at the time of his retirement was employed in San Francisco Division.

**Forest R. Cleveland.** 63 years of age, having been born April 17, 1868. Entered the service of the Standard Electric Company October 1, 1900, and at the time of his retirement was employed in Sacramento Division.

**James Halnan.** 63 years of age, having been born April 24, 1868. Entered the service of the Oakland Gas Light and Heat Company March 1, 1886, and at the time of his retirement was employed in East Bay Division.

**Raymond Biven.** 53 years of age, having been born June 28, 1878. Entered the service of the Oakland Gas Light and Heat Company October 7, 1901, and at the time of his retirement was employed in East Bay Division.

## The Financial Side of "Pacific Service"

Following is a preliminary statement of the Company's consolidated income account for the twelve months ended December 31, 1931, compared with the same period of the preceding year. This statement, for comparative purposes, includes the operations of all subsidiaries during both 1930 and 1931:

	12 Mos. to DEC. 31, 1931	COMPARISON WITH 12 MONTHS ENDED DEC. 31, 1930	
		Increase	Decrease
Gross Revenue, including Miscellaneous Income.....	\$88,536,846	\$2,033,592	.....
Maintenance, Operating Expenses, Taxes (including Federal Taxes) and Reserves for Casualties and Uncollectible Accounts.....	37,512,845	.....	\$ 42,094
Net Income.....	\$51,024,001	\$2,075,686	.....
Bond Interest and Discount.....	15,367,417	297,937	.....
Balance.....	\$35,656,584	\$1,777,749	.....
Reserve for Depreciation.....	10,865,202	900,240	.....
Surplus.....	\$24,791,382	\$ 877,509	.....
Dividends Paid on Preferred Stock.....	7,803,316	130,889	.....
Balance.....	\$16,988,066	\$ 746,620	.....
Dividends Paid on Common Stock.....	12,198,116	879,874	.....
Balance.....	\$ 4,789,950	.....	\$133,254

Earnings for the common stock in 1931 amounted to \$2.79 per share upon an average of 6,095,659 shares outstanding during the year, compared with \$2.87 per share on an average of 336,538 fewer shares in the preceding year. There were 6,232,156 shares of common stock held by the public at December 31, 1931, upon which earnings were equivalent to \$2.73 per share.

### SALES OF FIRST PREFERRED 6% STOCK

In order to provide capital funds to finance a portion of its construction requirements during the current year, the Company recently secured from the State Railroad Commission an authorization to sell \$5,000,000 par value of its first preferred 6% stock. This stock was offered for sale direct to the Company's existing preferred stockholders, and also to the general public in the territory served. The response to this offering emphasizes the confidence with which the Company's preferred stock is regarded by the investing public, particularly in a period when the generally depressed condition of the stock market might ordinarily be expected to make new financing difficult or expensive.

Sales averaged \$1,000,000 per week, the entire issue being disposed of in the period from January 28th to March 4th, 1932. The total number of subscriptions during this period was 7,296, received from all sections of the Company's territory, and averaging \$685 per purchaser. This indicates intensive distribution and a substantial accession to the Company's already large list of local stockholders. About three-fourths of the stock was paid for in full and about one-fourth purchased on the installment basis. Since inaugurating Customer Ownership in 1914, the Company has sold a total of \$76,000,000 of its Preferred Stock over its own counters.

CONSOLIDATED BALANCE SHEET, DECEMBER 31, 1931  
(Including All Subsidiary and Affiliated Companies)

ASSETS

Plants and Properties .....	\$653,837,112
Discount and Expenses on Capital Stock.....	778,408
Investments (including investment in Standard-Pacific Gas Line, Inc.).....	4,613,521
Sinking Fund and Other Deposits.....	302,082
Current Assets:	
Cash .....	\$14,744,441
Other Current Assets .....	15,702,757
Total Current Assets.....	30,447,198
Deferred Charges:	
Discount and Expense on Funded Debt.....	\$15,079,612
Unexpired Taxes and Undistributed Suspense Items.....	3,524,447
Total Deferred Charges .....	18,604,059
Total Assets.....	\$708,582,380

LIABILITIES

Common Stock in Hands of Public.....	\$155,906,357
Preferred Stock in Hands of Public.....	133,512,257
Minority Interest in Common Stock and Surplus of Subsidiaries.....	216,803
Funded Debt:	
Pacific Gas and Electric Co., including underlying issues.....	\$232,383,900
Affiliated Companies .....	76,371,500
Total Funded Debt.....	308,755,400
Current and Accrued Liabilities:	
Notes Payable .....	None
Current Liabilities .....	\$ 4,470,864
Interest, Taxes and Dividends Accrued but not due.....	17,487,467
Total Current and Accrued Liabilities.....	21,958,331
Reserves:	
For Depreciation .....	\$51,275,244
For Insurance and Casualties, etc.....	5,262,864
Total Reserves .....	56,538,108
Surplus:	
Earned.....	\$29,927,963
Capital.....	1,767,161
Total Surplus .....	31,695,124
Total Liabilities.....	\$708,582,380

NOTE: Messrs. Haskins & Sells, Certified Public Accountants, are now engaged in their annual audit of the company's accounts. The foregoing statements for the year 1931 are therefore in preliminary form, but it is anticipated that there will be no substantial differences in the final statements certified by the auditors, which will appear in the company's annual report.

# Pacific Service Magazine

PUBLISHED QUARTERLY IN THE INTERESTS OF

PACIFIC GAS AND ELECTRIC COMPANY

FREDERICK S. MYRTLE · EDITOR-IN-CHIEF

PACIFIC GAS AND ELECTRIC COMPANY

245 Market St., San Francisco

*The Pacific Gas and Electric Company desires to serve its patrons in the best possible manner. Any consumer not satisfied with his service will confer a favor upon the management by taking the matter up with the division headquarters.*

VOL. XVIII JANUARY, 1932 No. 7

We have entered upon another year and we are all speculating as to how it will turn out.

The business depression that has cast a wet blanket over industrial activity everywhere is still with us. Born of panic and nurtured in timidity, it has had more than two years of a miserable existence, and that is long enough for any obstacle to impede a nation's progress. It is difficult, nay, impossible to believe that a country like ours, with its limitless resources and the indomitable spirit of its citizenship, can be checked in its onward course for an indefinite period. So, we earnestly express the hope that this year of 1932 will see a very decided change in conditions generally. Meanwhile, we possess our souls in patience and we go about our allotted tasks with unabated energy.

With regard to the public service, it is encouraging to note that the light, heat and power utilities, for the most part, maintained an excellent record during 1931. It would be absurd, of course, to suggest that they did not feel the depression. They did. But, a public utility is a public servant and as such must not only operate under any and all conditions but, also, must be ready at all times to render adequate and dependable service to its consumers. By maintaining high standards of efficiency and observing strict economies of operation the California light, heat and power utilities, particularly, were able, during 1931 to proceed with major construction projects and, at the same time, provide such extensions and betterments of service as to satisfy their consumers and, wherever possible, stimulate business activity. In this connection the following statement by our company's president, Mr. A. F. Hocken-

beamer, during the closing week of 1931 may be of interest to our readers:

"California gas and electric utilities will close the old year with credit unimpaired, with dividends undiminished and with margins earned above established dividend rates sufficient to give every reasonable assurance of the continuance of these rates. Regular payments by these utilities, running into many millions of dollars to 220,000 stockholders living in California, to a large but unascertainable number of bondholders, to many thousands of employees, and additional large sums to local industries for material and machinery have played an important part in making California one of the comparatively white spots on the business map. The Pacific Gas and Electric Company, alone, during 1931 paid out \$25,000,000 in wages to an average of 14,000 employees, \$20,000,000 in dividends, including those paid to 68,000 California stockholders, \$16,000,000 in bond interest and \$30,000,000 in payments to merchants, manufacturers and others. Of these total disbursements of \$91,000,000, it is safe to say that not less than \$60,000,000 represents cash placed in circulation in Northern and Central California through the Company's ordinary operations.

"Natural gas in 1931 adequately demonstrated the low cost we promised for it in 1930. Factories and homes benefited by its high heat value and thousands of users found their fuel bills cut in two. A fair estimate indicates that over the Pacific Gas and Electric Company system gas consumers saved \$10,000,000 in their gas bills in 1931. This also was helpful in offsetting the effects of the business depression.

"California utilities will enter the new year under conditions which, on the whole, appear to be somewhat more favorable than those prevailing a year ago. In the past two years facilities were expanded to meet the needs of future growth while new money was still procurable at reasonable rates. The latter condition does not obtain today. They are not, therefore, for one thing, confronted with any immediate problems of major construction and financing of a necessitous character. It is estimated that for the entire United States public utility corporation bonds and notes maturing in 1932 will exceed half a billion dollars. This allows nothing for new capital needs for additions, betterments and improvements. Only a very small part of this burden of refinancing will fall on California

utilities. The Pacific Gas and Electric Company completed its \$35,000,000 refunding program in 1931 and its bond maturities in 1932 comprise only two small issues, aggregating \$1,012,000. From an operating standpoint conditions are more favorable. The year 1931 was characterized by extreme water shortage and the necessity of operating steam plants to meet the hydro-electric deficiency largely increased the fuel bills of the electric companies. Recent heavy rains with a heavy snow coverage in the Sierras and several months of winter still ahead have assured the largest supply of water for the operation of hydro-electric plants within a decade.

"The electrical output of California's three major electric companies for 1931 will be somewhere near eight and one-quarter billion kilowatt hours, or within  $\frac{1}{10}$  of 1 per cent of the output of the preceding year. This compares with a decline in output of about 4 per cent for the electric industry outside of California. The Pacific Gas and Electric Company will show an increase of about  $1\frac{3}{4}$  per cent in electric sales during 1931. It is difficult to make any forecast for 1932, but our surveys indicate that we may sign about the same amount of new business as in 1931 by intensifying sales efforts. Electric refrigerators, electric cooking and heating, and house-heating with natural gas are the most promising fields now in prospect and it is to these that we shall apply ourselves most vigorously and in which we anticipate the most satisfactory growth. The gas and electric industry ought to hold its own in 1932 if it appropriates sufficient funds to enable its commercial departments to carry on adequate campaigns of advertising and of general sales promotion.

"With fairly good business conditions and no insuperable difficulties in obtaining new capital on reasonable terms, expenditures by California utilities for additional gas and electric generating and distributing facilities will probably be around \$50,000,000 in 1932. Pacific Gas and Electric Company, serving substantially all of Northern and Central California, has a tentative construction budget of \$31,000,000. It includes the three largest undertakings so far projected by any of the California utilities for 1932, namely, the construction of a 50,000-k.w. steam plant in the southern end of the San Joaquin Valley in close proximity to the natural gas fields, a second natural gas transmission line from San Jose to San Francisco, giving San Francisco a double line all the way from the gas

fields, and the installation of 56,000 additional horsepower of hydro-electric energy on its Mokelumne project. This budget, however, is elastic and may be varied to suit the trend of business and of financial conditions. Capital expenditures approximating \$80,000,000 during the past two years have placed the company in an excellent position to cut its cloth this year according to its means. It hopes, however, to make its contribution to general economic recovery by carrying out substantially its present program."

A power famine in sections of Northern and Central California and a considerable portion of Nevada was averted during the last few months of 1931 by the Pacific Gas and Electric Company and the San Joaquin Light and Power Corporation, its subsidiary. This is revealed by Mr. P. M. Downing, our company's vice-president and general manager, in a review of conditions during the six months preceding the December storms.

Mr. Downing's statement shows that shortage of water caused the complete shutdown of many individual hydro-electric projects and greatly reduced the output of others. In most cases the P. G. and E. stepped into the breach and, through the water resources behind its far-flung hydro-electric system and its powerful steam generating plants, took up the load and made possible a full supply of electricity for every consumer in the affected areas. In others relief was furnished by the San Joaquin Company.

Compared with figures for 1930, the power shortage made up by the combined companies totaled prior to December 1st approximately 330 million kilowatt-hours, enough to supply all San Francisco's electric needs for 200 days.

In number of persons and size of areas affected, the power shortages of the Sierra Pacific Power Company and the Modesto Irrigation District were the most serious, since both are in the power distribution business.

The Sierra Pacific Company, which generates power on the Truckee River, has about 11,000 consumers in Reno, Carson City, Sparks, Virginia City and other Western Nevada communities. In addition, it serves several mines employing large numbers of men. Sierra Pacific was forced to turn to the P. G. and E. for relief last spring and has been buying power ever since, through a hook-up at the Donner Summit in Placer

County. Power deliveries from the Pacific system to the Nevada system totaled 216,000 kilowatt-hours in May and more than 2,000,000 kilowatt-hours in June, while in July and August our company furnished virtually the entire supply of electricity to the Nevada territory — about 5,500,000 kilowatt-hours a month. September brought a slight decrease, but the Sierra company is still dependent on the P. G. and E.

The Modesto Irrigation District, which serves about 7,900 electric consumers in the city of Modesto and adjacent territory, ran short of power about September 1st and from that date bought electricity from the San Joaquin Light and Power Corporation to enable it to maintain full service. Deliveries from the San Joaquin system for that purpose amounted to as much as 100,000 kilowatt-hours in a single day.

In normal years the Modesto District and the Turlock Irrigation District share the output of two power-houses, the 40,000-horsepower plant at the base of Don Pedro dam in Tuolumne County and the 5,600-horsepower plant at La Grange, six miles below the dam. Turlock district sells much of its share of power to the San Joaquin Company, and its predicament last year was limited to a loss in revenue. The power shortage of the two districts to December 1st totaled approximately 55 million kilowatt-hours, representing a loss to the district of about \$221,000.

Merced Irrigation District, which also sells power to the San Joaquin Company in normal times, was without water from July 1st. As a result, its power plant at the Exchequer Reservoir stood idle from that date and its shortage to December 1st totaled close to 70 million kilowatt-hours. The District's revenue loss totaled approximately \$317,000.

Several other projects hit by the water shortage have for several years sold part, if not all, of their electric output to the P. G. and E. Closing down or partial closing down of their generating facilities meant that they suffered financial loss and that the P. G. and E. had to draw more heavily on its own power resources to make up the deficits. But our company was prepared. As early as last January it anticipated a dry season and operated its system so as to conserve sufficient water storage to meet stream flow deficiencies during the summer and early fall.

One of its water conservation methods was to make the fullest possible use of large steam electric-generating plants in San Fran-

cisco, Oakland and Sacramento, all of which are connected up with the company's transmission network. In the first eleven months of 1931 the combined output of these steam plants exceeded two billion fifty million kilowatt-hours, as compared with a total of 291 million in the corresponding period of 1930.

Output of Moccasin Creek and Early Intake generating plants on San Francisco's Hetch-Hetchy system began to decrease in August and the power-houses were forced to practically close down on September 5th. In view of the amount of power which the city of San Francisco normally delivers to the P. G. and E., the shutting down of its plants might have been expected to create a power shortage that would have seriously handicapped service. The company's reserve generating equipment, however, maintained to meet just such emergencies, made up this deficit and our service was in no way affected.

Under normal conditions, the city receives an average revenue of \$195,000 a month for power which is distributed by the P. G. and E., as its agent. This year, however, the O'Shaughnessy reservoir's maximum storage mark was but 126,812 acre-feet, as compared with 205,052 acre-feet in a normal year. As a consequence of the early exhaustion of the water supply, San Francisco suffered a power-revenue loss to December 1st of \$911,000. Its check from the P. G. and E. for power delivered in September was only \$16,975.84, instead of its usual monthly check of approximately \$195,000. The October check amounted to only \$842.94 and that for November, \$690.75.

The East Bay Utility District, which supplies water to the East Bay cities, suffered a power-revenue loss of about \$208,600. This district operates a 20,000-horsepower generating plant below its Pardee dam on the Mokelumne River in Calaveras County.

The Nevada Irrigation District, which furnishes water to Grass Valley and Nevada City and to farmers in Sierra, Nevada and Placer Counties, suffered a revenue loss of \$170,000 because of water shortages. This district operates no power plants, but its water supply is used to generate power in a string of P. G. and E. plants while it is en route from the district's Lake Bowman reservoir at the headwaters of Canyon Creek, a tributary of South Yuba River, to its water consumers. Besides having its receipts from the P. G. and E. curtailed, the district was dependent on the company for part of the

water necessary to maintain its irrigation and domestic water service.

It will be seen from the foregoing that our company's policy and foresight in the conservation of its controlled water resources is an extremely valuable asset to the people of this state, as well as being an important feature in the effective operation of a comprehensive hydro-electric system such as that known far and wide as "Pacific Service." Our company's water storage system includes 121 lakes and reservoirs, including the storage resources of the San Joaquin Company, of an aggregate storage capacity of 673,258,870,000 gallons. This amount of water would supply the city of San Francisco at the present rate of consumption for approximately 37 years. The water from these lakes and reservoirs, in addition to being used for power development, is at the disposal of farmers and irrigation districts during the irrigation season each year. When the runoff from the winter snows has filled these reservoirs the release is gradual and as service needs demand. It was fortunate, indeed, for power companies and agriculturists alike that such a water system as ours was available to avert what might have been very serious disaster.

The management of the Pacific Gas and Electric Company has always endeavored to keep in close touch with its employees. It is fully realized that the best way to bring about complete understanding between individuals is by contact. Good public relations are a direct reflection of the attitude of the man on the job. The cordial relationship which exists between the employees of the Company and the management is due to the fact that the management knows its employees and, in turn, the employees know the management.

In a large industrial organization continuous effort must be put forth by the management in order to maintain a close and happy relationship with its great body of employees. Our company has always been in the forefront in this endeavor. In the last few months a very definite and successful effort has been under way. The officers of the company, management officers and department heads of the General Office have been appearing before groups of employees in every Division of the "Pacific Service" territory. At each meeting, one of the management group addresses the employees on some function or activity of the company. After the address,

the meeting is thrown open for questions and discussion by the employees. Every employee is thus given an opportunity to learn of the work carried on by the General Office departments and to become acquainted with the individual heading up that particular activity for the company. The General Office executive has an opportunity to see and meet the employees of each division.

These meetings have been entirely educational in nature and because of the number in attendance it has been necessary to limit them to employees only. By the middle of December, 54 had been held throughout the territory of the company. The attendance at these 54 meetings totaled 12,656. A truly remarkable showing.

The following is a list of the subjects covered, together with the speakers:

1. Management and Its Functions.  
P. M. Downing, Vice-President and General Manager.
2. Financial Structure of Pacific Gas and Electric Company.  
A. F. Hockenbeamer, President.  
E. J. Beckett, Assistant Treasurer.
3. Pacific Gas and Electric Company Organization.  
P. M. Downing, Vice-President and General Manager.  
E. G. McCann, Manager, Personnel Department.
4. (a) The Company's Tax Problem.  
(b) Agitation and Public Policy.  
J. P. Coghlan, Second Vice-President and Assistant to President.
5. Public Utility Rate Fixing.  
W. G. Vincent, Vice-President and Executive Engineer.
6. The Development of Natural Gas in the Pacific Gas and Electric Company.  
W. S. Yard, Vice-President in Charge of Gas Construction and Operation.  
F. F. Doyle, Manager, Natural Gas Division.
7. Certain Aspects of Company Legal Problems.  
T. J. Straub, General Attorney, Law Department.
8. The Functions of the Supply Department.  
F. P. Hanson, Manager, Purchases and Stores Department.  
A. A. Charonnat, Superintendent of Stores.
9. (a) Technique of Executive Control.  
(b) The Human Side of Pacific Service.  
E. G. McCann, Manager, Personnel Department.
10. Public Utility Advertising.  
A. C. Joy, Manager, Publicity Department.
11. Problems in Electric Operation.  
F. R. George, Engineer of Electrical Operation.

12. Load Dispatching Methods.  
W. D. Skinner, Chief Load Dispatcher.
13. Our Recent Construction Program.  
O. W. Peterson, Engineer of General Construction.
14. (a) Hydro-Electric Development in the Pacific Gas and Electric Company.  
(b) Transmission Problems.  
J. P. Jollyman, Chief of Division of Hydro-Electric and Transmission Engineering.
15. Steam Generating and Its Future.  
A. H. Markwart, Vice-President in Charge of Engineering.
16. The Distribution of Electric Energy.  
S. J. Lisberger, Chief of Division of Electric Distribution and Steam Engineering.
17. Rate Interpretations and Commercial Practices.  
Classes of Service and Requirements.  
R. E. Fisher, Vice-President in Charge of Public Relations and Sales.  
N. R. Sutherland, Manager, Commercial Department.
18. General Treatment of Consumers.  
Public Relations Aspect of Conduct of Employees.  
R. E. Fisher, Vice-President in Charge of Public Relations and Sales.  
D. C. Ray, Manager, Bureau of Public Relations.
19. General Sales Policies.  
Dealer Co-operation.  
Employee Participation in Sales.  
R. E. Fisher, Vice-President in Charge of Public Relations and Sales.  
H. M. Crawford, General Sales Manager.
20. Public Utility Regulation, Its Theory and Practice.  
C. P. Cutten, Attorney, Rate Department.
21. Scope and Function of Public Utility Accounting.  
E. W. Hodges, Comptroller.

### PROFITS FROM PUBLIC UTILITY

(Editorial in Manteca Bulletin, Dec. 31, 1931)

The receipt of a check for \$32,342.75 by the South San Joaquin Irrigation District from the Pacific Gas & Electric Co. last week should be a reminder of the good fortune and foresight the district enjoyed in its contract for construction of Melones reservoir.

Every now and then some public ownership enthusiast rises to condemn the contract which the irrigation directors made with the P. G. & E. some years ago, and to point out how the property owners have been losing millions by "selling out" to the public service corporation.

Strange to relate, however, there has been a discreet silence maintained by these enthusiasts during the past year.

For, quite a number of districts which harkened to the lure of public ownership of public utilities are this year, because of the water shortage, "wishing they hadn't."

The South San Joaquin and Oakdale districts are receiving \$130,000 annually from the power corporation, sufficient to pay interest on Melones bonds and also part of the principal.

Had the districts attempted to operate their own power plant, as was strongly advocated at the time, they would not only be out the \$100,000 interest on the reservoir, but also the interest on the cost of the generating plant, another \$120,000.

So, in addition to our difficulties due to low farm prices and increased tax delinquencies, the district would have faced an even greater problem in losses on both power plant and dam.

Thank you, we are pretty well satisfied with the arrangement under which we receive Melones storage water, without costing the farmers one cent.

### KEEP OUR HEADS!

(Editorial in S. F. Industrial Review,  
Jan. 16, 1932)

The so-called "power issue" has furnished the excuse for an immense amount of cheap political ballyhoo.

We hear, on the one hand, that the power industry is an iniquitous octopus, devouring an excessive share of the citizen's income and thrusting its tentacles into every phase of his life. On the other hand, we sometimes hear that the power industry is a sublime and perfect thing.

The truth lies somewhere between these two extremes. There are undoubtedly flaws in the immense structure of the power industry — exactly as there are flaws in every human activity. Perfection is not of this world. This much is fact:

The power industry, in the brief span of its existence, has made a most remarkable record in improving and broadening its service to customers and, at the same time, constantly lowering the cost of that service. Perhaps no other industry has ever made so outstanding a record for the benefit of mankind. And in the face of that, it is improbable that malicious and self-serving criticism — something distinct from honest criticism that may be deserved — will sway a public which is worrying far more about its tax bill than about its power bill.

# PACIFIC GAS AND ELECTRIC COMPANY

A CALIFORNIA CORPORATION

Managed by Californians

Operated by Californians

THE CONSOLIDATED "PACIFIC SERVICE" SYSTEM REPRESENTS (as of June 30, 1931)

13,830 employed in all departments.

\$650,000,000 capital invested in gas, electricity, street railway, steam and water plants.

85,000 square miles of territory in which it operates—an area greater than that of England and Wales.

85,000 stockholders.

45 counties of the State in which it transacts business.

1,246,600 consumers served with gas, electricity, water and steam.

2,750,000 people in 45 counties, which is approximately 50 per cent of the State population.

618 cities and towns in which it supplies service directly and through other companies.

\$27,979,000 annual wages paid employees, year ending June 30, 1931.

\$9,345,000 taxes, Federal, State, county and local, year ending June 30, 1931.

1,177,807 horsepower developed in 50 electric water-power plants.

510,188 horsepower developed in 15 electric steam plants.

1,687,995 total horsepower developed in 65 plants.

3,320,667,000 kw. hours sold, year ending June 30, 1931. This is equivalent to the effort of 11,069,000 men.

24,237,752,000 cubic feet of gas sold, year ending June 30, 1931.

33,397 miles of electric transmission and distribution lines. Greater than the distance around the earth.

6,931 miles of mains used in distributing gas. Greater than the distance between San Francisco and Oslo, Norway.

955 miles of mains and ditches used in distributing power.

1,370 miles of track of railway supplied with electric power.

616,395,950,000 gallons of water storage capacity of 115 lakes and reservoirs. This amount of water would supply the City of San Francisco at the present rate of consumption for approximately 34 years.

215,121 acres of land owned in California.

572 parcels of property owned in cities and towns.

577,284 horsepower in agricultural motors depending on "Pacific Service."

1,064,083 horsepower in mining, electric railways, manufacturing and other motors depending on "Pacific Service."

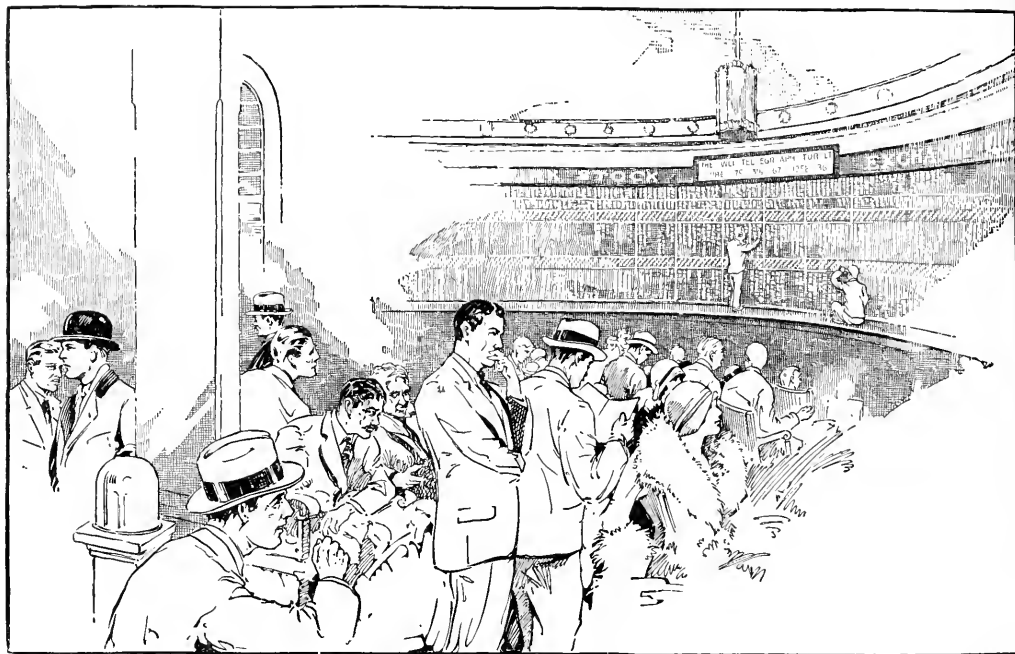
3,597,026 horsepower connected to system.

PACIFIC GAS AND ELECTRIC COMPANY

General Offices: 245 Market Street

San Francisco

Branches in all principal cities and towns of 45 counties of North Central California.



## You Need Not Worry About Stock Market Quotations

*if you own Pacific Gas and Electric Company  
First Preferred Cumulative Stock.*

In good times and bad, in boom and depression, this Company's First Preferred Stock has paid dividends with punctilious regularity. The fifty-four thousand holders of this high-grade security have never had occasion to entertain the slightest uneasiness as to the safety of their investment.

This stock is non-assessable and non-callable and is exempt from Personal Property Tax in California and from the Federal Normal Individual Income Tax.

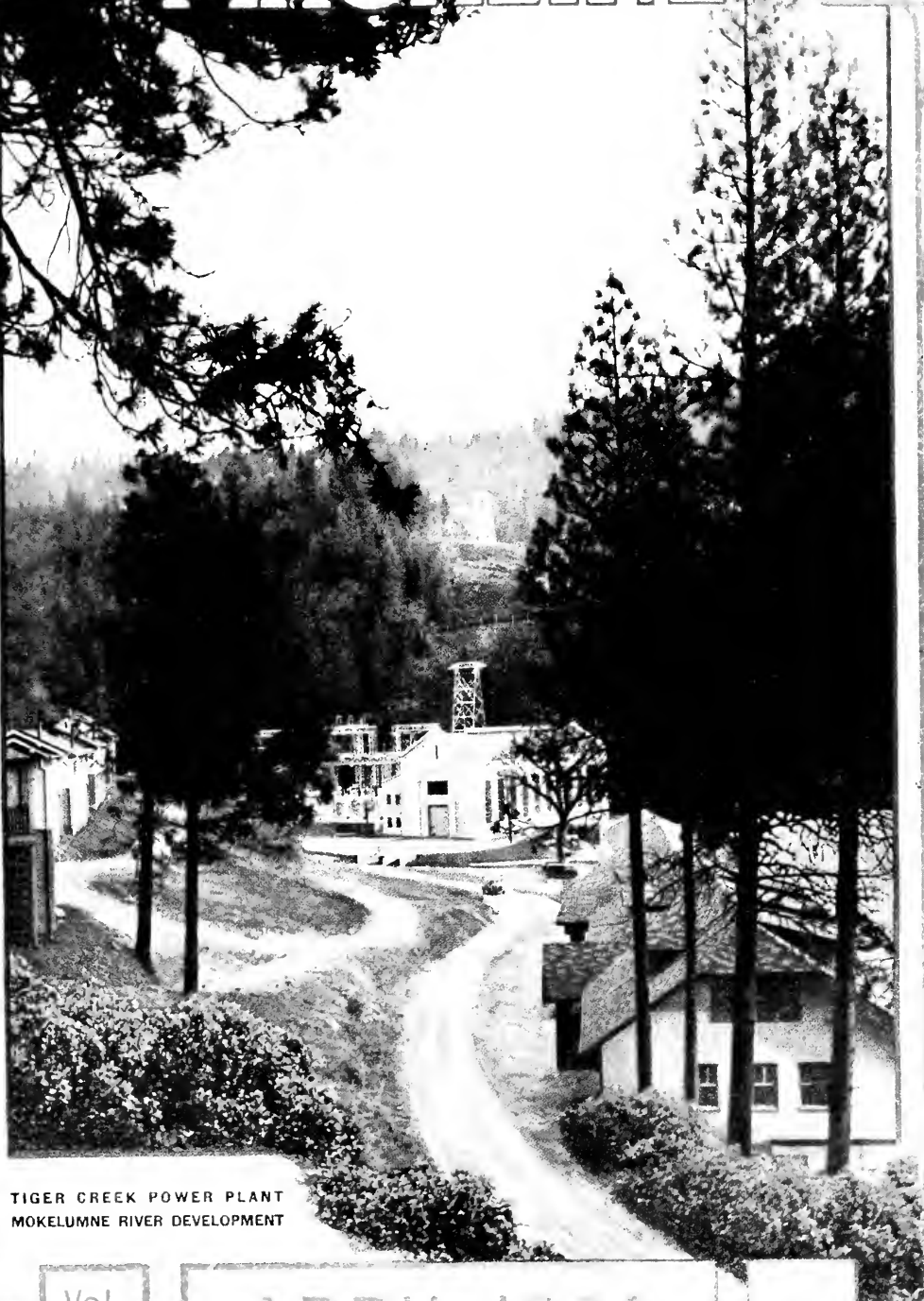
Circulars descriptive of this investment issue will be mailed upon request.

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PACIFIC GAS AND ELECTRIC COMPANY  
STOCK SALES DEPARTMENT • 245 MARKET STREET • SAN FRANCISCO

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# PACIFIC SERVICE MAGAZINE



TIGER CREEK POWER PLANT  
MOKELUMNE RIVER DEVELOPMENT

Vol  
18

APRIL 1932

# PACIFIC GAS AND ELECTRIC COMPANY

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CHAS. L. BARRETT	Assistant Secretary

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W. G. VINCENT, Vice-President and Executive Engineer  
W. S. YARD, Vice-President in Charge of Gas Construction and Operation  
R. E. FISHER, Vice-President in Charge of Public Relations and Sales

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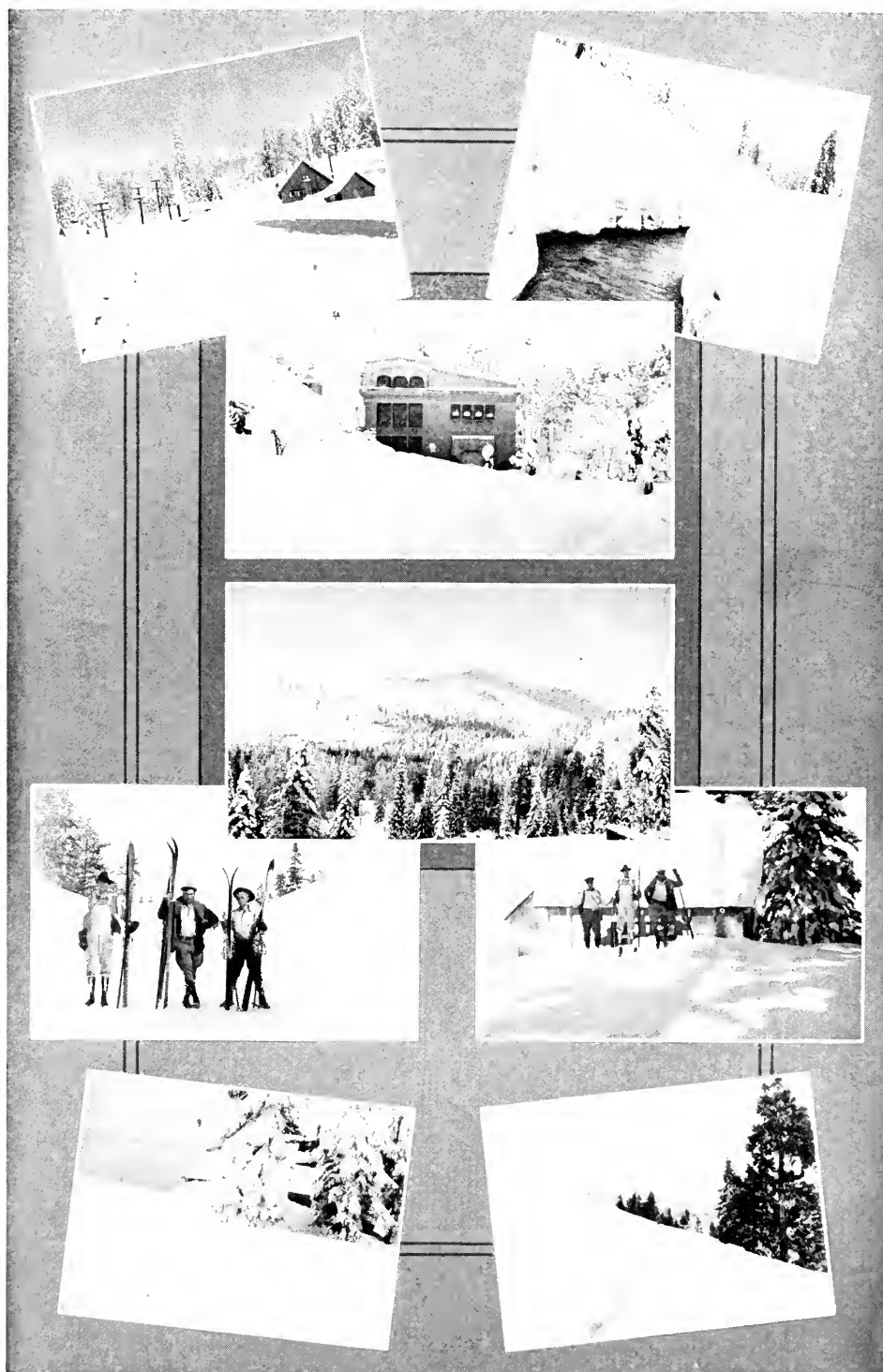
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Views of the Spaulding-Drum district. South Yuba-Bear River development, during the past winter, —Reading left to right: operators' cottages near Lake Spaulding; Bear River canal; Drum powerhouse; Red Mountain from near Cisco; Lincoln highway; camp grounds near Cisco; operator's cottage under difficulties; trail leading to Spaulding dam.

# PACIFIC SERVICE MAGAZINE

Volume XVIII

APRIL, 1932

Number 8

## *"Pacific Service" Record for 1931*

*Annual report reveals satisfactory result of the company's activities in a year of acute economic distress, with adverse business conditions and unusual operating difficulties.*

The twenty-sixth annual report of the Pacific Gas and Electric Company and its affiliated companies was presented to the company's stockholders at the annual meeting held at headquarters in San Francisco, April 12th.

The year 1931 was one of acute economic distress and unusual operating difficulties. Adverse business conditions were reflected in reduced purchasing power of the public, diminished building and generally lowered industrial activity. Substantial rate reductions, also, were an adverse factor that had to be overcome in a period when recovery of reduced gross revenues was most difficult. Taking these drawbacks into consideration, the "Pacific Service" record for 1931 as disclosed at the stockholders' meeting was distinctly satisfactory, especially when contrasted with the showing made by other similar utilities in practically all sections of the country.

The company's gross operating revenues from all sources during the past year aggregated \$87,630,661, exceeding by \$1,997,520 those of all companies included in the present "Pacific Service" consolidated system for the full year 1930. Of this grand total \$66,123,741, or 75.46 per cent, was derived from the sale of electricity, \$19,719,538, or 22.50 per cent, from gas sales, and \$1,787,882, or 2.04 per cent, from minor sources of revenue including the street railway, water and irrigation and steam sales departments.

Sales of electricity in the consolidated system aggregated 3,351,343,235 kilowatt-hours, a new record, exceeding by 62,088,081 kilowatt-hours, or 1.89 per cent, the volume of sales by all constituent companies during the preceding year. The gross revenue therefrom exceeded that of the preceding year by \$1,134,503, or 1.7 per cent. As of December 31, 1931, the total number of customers for electric service was 740,467, an increase of 11,428, or 1.6 per cent, over the number registered at the close of 1930. These figures reveal a degree of expansion considerably less than the average of past years, but they also indicate that the effects of the prevalent depression were experienced by our company in a lesser degree than by the industry as a whole, national totals showing a decline in volume of electric sales of 4.3 per cent as compared with 1930. With the exception of a decrease of 4.59 per cent in sales of energy for industrial and general power purposes, every class of electric service showed an increase in sales volume. Substantial gains were recorded in sales to domestic and commercial consumers, ranging from an increase of 6.47 per cent in sales for street lighting to one of 16.23 per cent in sales for lighting public buildings. Sales for domestic heating and cooking increased 6.28 per cent, for commercial heating and cooking 12.36 per cent and for domestic lighting 7.06 per cent. These increases, while in a considerable degree attributable to the more complete electrification of homes and business establishments resulting from an actively prosecuted business development campaign, were also favorably influenced by the downward trend in average unit prices paid for electricity. Our company has so designed its rate schedules as to encourage larger usage through a sliding scale of prices, and this policy is reflected in a general increase of average annual and commercial consumption. Taking the record of the past ten years as an example, the company in 1931 had to sell 23 kilowatt-hours to a domestic or commercial consumer to produce the same amount of revenue derived from the sale of 14 kilowatt-hours in 1921.

Electric service at the close of 1931 was supplied to 618 cities and towns in the "Pacific Service" territory, 578 served directly and 40 indirectly, and to a very large rural area. The average "load" on the company's lines throughout the year was 62.1 per cent of maximum demand, indicating the exceptionally well diversified character of the company's electric business. As of December 31, 1931, the company operated 50 water-power plants, with an aggregate installed capacity of 1,178,477 horsepower, and 15 steam-electric generating stations with an installed capacity of 510,187 horsepower; aggregate installed generating capacity of plants in the company's service, 1,688,644 horsepower. Electric transmission and distribution facilities included 505.49 miles of 220,000-volt lines, 397.70 miles of 165,000-volt lines, 1,633.68 miles of 110,000-volt lines, 3,665.06 miles of 60,000-volt lines; total length of high-tension transmission lines, 6,201.96 miles; total length of lower voltage distribution lines, 28,319.94 miles; total transmission and distribution lines, 34,521.90 miles.

Sales of gas on the consolidated system aggregated 29,429,747,100 cubic feet, an increase of 6,351,711,200 cubic feet, or 27.5 per cent, over the 1930 record. This, in fact, was the greatest increase in sales volume of any year in the company's history. The revenue realized for these sales exceeded that recorded for 1930 by \$998,363, or 5.3 per cent. It will be seen that there is a disparity between the ratios of sales volume and sales revenue; this is accounted for, partly, by the increased volume of gas sold at wholesale rates to major industrial consumers, in a larger degree, by the saving to consumers generally through the introduction of natural gas which, as previously explained to our readers, has twice the heating value of the artificial product and is, therefore, more economical. In addition to its sales to the public, the company used 15,000,000,000 cubic feet of natural gas as fuel for its steam-electric generating plants and 1,170,541,000 cubic feet in its steam-heating plants. The volume of natural gas transported from the San Joaquin Valley oil fields through the two main transmission pipe lines for our company's account had a daily average of 154,821,000 cubic feet in December, 1931, with a maximum of 159,311,000 cubic feet on the last day of the year.

At the close of the year 516,169 customers for gas service were connected to the company's distribution lines, an increase of 9,316 during the twelve months' period.

Active efforts directed toward the conservation of the natural resources of the California gas and oil fields were continued during 1931 and met with a large measure of success. The outstanding example is the organization, during the past year, of the Kettleman North Dome Association, as a result of which the drilling and producing activities of a number of oil and gas companies were placed under a unified plan of operation, permitting a more orderly development of the Kettleman field, one of the largest producing areas in the world and from which our company at the present time receives its entire output of natural gas. The company has an additional source of production in the Buttonwillow field, south of Kettleman, but in the interest of conservation no gas was drawn from the field during 1931. The prevention of unnecessary or uneconomical production in the Kettleman field is, of course, beneficial to the company as the major distributor of natural gas throughout the northern and central sections of California.

Drilling operations in the Kettleman Hills area during 1931 resulted in the completion of 26 producing wells, with a combined initial output exceeding 600,000,000 cubic feet of natural gas per day. An important feature of this operation was the drilling of a well in the so-called Middle Dome of the Kettleman fields, which proved the existence of a productive area in the Middle Dome estimated at 2,300 acres in extent and giving assurance of an additional potential gas supply of large proportions.

A carefully prepared and vigorously executed advertising and sales campaign, involving the expenditure of approximately \$1,200,000, was conducted during 1931 and met with a substantial measure of success, notwithstanding the greater sales resistance resulting from adverse economic conditions. In the territory served by the Pacific Gas and Electric Company contracts were signed which are estimated to yield an annual revenue of \$9,193,000, or \$7.66 per dollar of sales expense, and approximately \$250,000 in excess of the quota established for the new business department in the latter part of 1930. In addition, new business was signed by the San Joaquin Light and Power Corporation, a sub-

siary, estimated to yield an annual revenue of \$1,662,000, so that the aggregate volume of new business contracted for on the entire system amounted to \$10,855,000 annually. This additional business was only partially reflected in our 1931 operations, and was to a large degree offset by discontinued or diminished usage by existing industrial and other consumers.

At the close of 1931 there were 451 industrial gas customers taking service from our lines, or approximately double the number at December 31, 1931.

Against the company's gross operating revenues there was paid out in operating and administrative expenses, taxes and reserves the sum of \$33,466,478. State, Federal and other taxes amounted to \$9,608,210, 10.3 per cent of the gross revenues and exceeding the amount so paid in 1930 by \$407,081. All other operating expenses, including salaries and wages paid to the administrative and operating personnel, purchases of power and fuel, material and supplies used in operation, commercial and new business expense, rentals and similar items were \$313,497 less than in the previous year. This reduction in direct operating costs was achieved notwithstanding the larger volume of business and the greater utilization, due to the exceptionally dry season, of the company's fuel-burning electric generating plants. It is interesting to note that the proportion of gross operating revenue required for the payment of operating and administrative costs and taxes has decreased steadily from 56 per cent in 1924 to 37 per cent in 1931.

Meanwhile, the operating economies introduced during recent years, including those arising out of the acquisition and consolidation of other properties and the heavier loading of existing facilities, have enabled the company to make repeated reductions in rates for its services. It is conservatively estimated that the savings to customers resulting from rate reductions during the past ten years and from the recent introduction of natural gas to displace the artificial product amount to not less than \$25,000,000 annually, or approximately \$5,000,000 in excess of a year's dividends on the entire outstanding issues of \$289,418,614 preferred and common stocks.

Maintenance, \$4,046,367; reserve for depreciation, \$10,865,202. These two items, which together represent the provision made from current earnings for the upkeep of the company's properties, aggregated \$14,911,569, or 17 per cent of the gross operating revenues. The accumulated balance in depreciation reserve at the close of the year, after writing off worn-out or obsolete properties, was \$51,275,244.

The net operating income, after the deduction of all operating expenses, maintenance, taxes and reserves, except depreciation reserve, amounted to \$50,117,816, an increase of \$2,039,615 over 1930. Adding to this total the sum of \$906,185 non-operating revenues, arising from interest or bank balances, income from investments, profit on appliance sales and other miscellaneous items, the total gross income in 1931 available for depreciation and a return to the company's security holders was \$51,024,001, or \$2,075,685 more than in 1930. There was paid out in bond interest during the year \$14,494,199, in bond discount and expense, \$873,218. The surplus available for the payment of dividends, after the deduction of all prior charges, amounted to \$24,791,383. Dividends paid upon the outstanding preferred stocks of the company and its subsidiaries, which at the close of the year were held by 63,140 investors, aggregated \$7,803,316. Common stock dividends, at the current rate of 8 per cent per annum, amounted to \$12,198,117. Balance after dividend payments, \$4,046,331.

At the close of 1931 the company's plants and properties account plus current assets exceeded by \$358,184,000 to total face value of bonds held by the public, the book value of fixed and working capital being placed at \$666,939,500 and the par value of all outstanding bonds at \$308,775,400. Current assets as shown in the balance sheet aggregated \$30,447,198, including \$14,744,441 of cash on hand, with no obligations other than ordinary current bills and the usual accruals for interest and other charges not yet due. No money has been borrowed from banks in eighteen years. There are no impending bond maturities in 1932 except two small issues aggregating \$1,012,000. Aside from the current assets as stated there has been advanced from working capital for construction and bond refunding operations \$40,781,017, against which no securities have been issued and for which the company's treasury is entitled to reimbursement. In addition, bonds on hand

available for sinking fund and other purposes aggregated \$7,245,500, and miscellaneous marketable securities \$938,521. Total working assets, including those susceptible of being put into liquid form, thus aggregated \$79,412,236, against which current liabilities amounted to only \$4,470,864 and interest, taxes and dividends accrued but not payable at the end of the year, \$17,487,467. After deduction of all current and accrued liabilities therefore, the company's net assets aggregated \$57,453,905.

Expenditures for new construction work on the "Pacific Service" consolidated system during 1931 totalled \$27,794,942, the greater part of which was financed through the issuance of additional securities. Two important projects reached a stage of practical completion. One was the Mokelumne River development, construction work on which was started in 1926. Much has been written of this spectacular project which is, in effect, an extension and enlargement of the old Electra system constructed by the Standard Electric Company at the beginning of the present century and is designed to bring into play all of the available power of the Mokelumne. What is technically termed the first unit of the development was officially placed in service early in July last, the opening ceremonies being attended by a delegation of journalists from all sections of the "Pacific Service" territory.

The starting point of the development is marked by a rock-fill dam spanning a gorge of the river near Salt Springs, about 40 miles upstream from Electra. The dam is 330 feet in height, measures 1300 feet along the crest and 900 feet through at the base. It impounds the waters of the river into a reservoir of 130,000 acre feet capacity. Immediately below the dam is located Salt Springs power-plant, with a present installed generating capacity of 14,745 horsepower. It is operated by water released from the dam and thence the water is conveyed by concrete flume and tunnel a distance of  $20\frac{1}{4}$  miles to a point where Tiger Creek flows into the main stream. There is located Tiger Creek power-house where the installed generating capacity is 80,429 horsepower.

Power developed at Salt Springs plant is transmitted to Tiger Creek by a 100,000 volt steel tower line  $16\frac{1}{2}$  miles in length. From Tiger Creek a double circuit 220,000 volt steel tower line carries the power to the company's high tension distributing station at Newark, in Alameda County, a distance of 108 miles. The transformer capacity at Newark has been enlarged to take care of the additional power. In addition, as the result of the corporate merger of the Great Western and San Joaquin companies with the Pacific Gas and Electric Company, two major tie-line connections have been completed which provide for the interchange of power between the Pacific Gas and Electric and Great Western systems, on the one hand, and the Pacific Gas and Electric and San Joaquin systems, on the other. The Pacific and Great Western systems have been interconnected at the former company's high-tension distributing station at Claremont, near Oakland. The San Joaquin system is brought into interconnection through a 220,000 volt line leaving Tiger Creek-Newark transmission at Bellota, a point 12 miles east of Stockton, and running down valley a distance of 98 miles to connect with the San Joaquin Corporation's recently constructed substation at Herndon, near Fresno.

The foregoing features comprise what is technically termed the first unit of the development, by which a total of 95,174 horsepower has been added to the combined hydro-electric generating resources of the "Pacific Service" system. Additional construction work has yet to be undertaken which, when completed, will enable the development to furnish an aggregate of 229,000 horsepower to the "Pacific Service" power pool, besides increasing the water storage facilities. Water storage is an important feature of a development of the kind, for, when the water released from Salt Springs and other reservoirs on the system has done its work in turning the wheels of a string of power-houses reaching down to Electra it is available for use by lower appropriators and riparian owners for municipal, domestic, irrigation and other purposes.

In the early part of the summer Pacific Gas and Electric Company completed the reconstruction of Station "A", its central steam-electric generating station at the Potrero in San Francisco, including the installation of two of a projected total of four high-pressure turbo-generators, each of 70,000 horsepower.

Prior to this construction work, which was started early in 1928, the generating

capacity of this station was rated around 85,000 horsepower. A portion of the standing equipment, however, was not up to modern requirements and this was pulled out to make room for the new installation, reducing the standing equipment to 40,000 horsepower generating capacity. Adding this to the new installation the station today has a rating of 174,263 horsepower. When the two additional high-pressure units come to be installed, the station's capacity will exceed 300,000 horsepower, after allowing for the probable removal of what remains of standing equipment at the time the reconstruction was started.

The value of an installation of this kind to the Pacific Gas and Electric Company cannot be over estimated. The series of winters of low rainfall in California has called attention to the present need of steam-electric plants as standby service, and there is likely to be considerable activity in this kind of development from now on.

The construction program of the gas department consisted of extensions, replacements and improvements to existing natural gas transmission and distribution systems. A 26-inch high pressure main was constructed from the Potrero gas works in San Francisco to the San Mateo County line. The further extension of this main to connect with the gas intake station at Milpitas will probably be completed before next winter. Milpitas is the junction point near the southern extremity of San Francisco Bay, at which converge the company's main trunk line from the Kettleman Hills and a branch line connecting at Tracy with the Standard-Pacific gas main from the Kettleman gas fields to Richmond. The completion of the new main will furnish San Francisco with a double source of gas supply from Milpitas.

New business offices and other facilities of modern type were constructed at various points on the company's system. Our construction program as carried out in 1931 afforded continuous employment to an average of more than 5,200 men, with an aggregate payroll exceeding \$9,600,000.

Since the company's organization in October, 1905, there has been expended in construction work a total of \$296,989,728, and \$284,067,550 in the acquisition of other utility properties. Every dollar in the construction column represents money actually expended in building additions and betterments to the system, and the addition of acquired properties has resulted in almost every instance in a substantial reduction of outstanding capitalization as compared with that of the companies so acquired. Furthermore, all such outlays have been made under the authorization of the Railroad Commission of the State of California.

An average of 13,643 men and women were employed on the "Pacific Service" consolidated system throughout 1931. Payrolls aggregated \$24,997,331, of which \$15,352,229 was paid to operating employees and \$9,645,102 to those engaged in construction work. At the close of the year there were 11,897 employees in the service of the company and its subsidiaries, of whom 10,288 were on the payroll of the parent company. Of these 6,178, or 60 per cent, hold service badges awarded in recognition of five or more years of continuous employment. At December 31, 1931, 133 retired employees were receiving pensions under a formal system placed in effect in 1916. Pension payments in 1931 aggregated \$109,418.

The Pacific Service Employees' Association, which is purely voluntary and includes substantially all permanent employees of every rank, had a membership of 9,086 at the close of the year. The activities of this association embrace educational and social work among employees, payment of death benefits and the rendering of temporary financial assistance in case of need. An increasing number of employees availed themselves of the educational courses conducted by the association, 657 certificates being awarded to students completing educational courses in 1931. Altogether 3,591 certificates have been awarded since the inauguration of these activities. An employees' disability plan, with a present membership of 6,758, is conducted by the association. The amount paid in benefits during 1931 aggregated \$63,352.20.

President A. F. Hockenbeamer presided at the annual meeting of stockholders. Reports of progress were presented by the President and Mr. P. M. Downing, First Vice-President and General Manager.

## Maintaining "Pacific Service" in the Regions of Heavy Snowfall

The winter of 1931-2 was distinguished by unusual depths of snowfall all over the State of California. The mountain-tops were blanketed early in the season and, at the time of writing, there is assurance of sufficient packed snow to fill reservoirs when the run-off period arrives.

The snowfall, too, has not been confined to the higher altitudes. Taking the 4000-foot level as a gauge, the records show an amount in excess of records for the past 35 years. Even the lower levels have been favored, particularly in the San Francisco bay area, where the encircling foothills glistened, from time to time, in true seasonal fashion as the winter sun cast its rays upon them.

Taking our "Pacific Service" territory, as an example, the packed snow in the Sierra Nevada region is above a 24-year normal record. At Lake Fordyce, the snowpack on the ground showed a depth of 108 inches on March 19th, 26 per cent above the 24-year record. At other elevations, notably in the Feather River country, the fall has been deep, and statistics showing unusual fall are received from the Tuolumne County mountains above Sonora, from the Sierra Nevada peaks southwest of Lake Tahoe, and elsewhere.

These conditions, while auguring well for power development and irrigation prospects, bore hard upon the men whose business it was to maintain "Pacific Service" under any and all conditions. Trouble-shooters and line patrolmen had their work cut out to make their way in the teeth of driving blizzards. Theirs was a task that called for the best that lay in them of fortitude and endurance. Most of these men are experts on skis, but in encountering depths of freshly fallen snow the skis sink at every step and the wearer has to literally plow his way through, slowly and laboriously. In one instance, it is of record that a party of men took five hours to travel four and one-half miles. In another, one man took forty minutes to travel one hundred and fifty yards!

There is the risk, too, of wandering from the beaten path, if so it may be called, and



Cabin at Niagara.

becoming lost in the storm. For obvious reasons, therefore, our company makes it a rule never to send out a man for any distance unaccompanied. Also, shelter stations, well stocked with winter supplies of food and other necessities, have been established at strategic points in the snow regions of the "Pacific Service" territory. Even then, the men get lost at times. During the past winter, one party was missing in the Feather River canyon for two days. It is not surprising, then, to learn that from time to time our Department of Electrical Operation and Maintenance is besieged with hurry-up calls asking for searching parties to be sent out to the relief of the strayed. In cases, however, where the missing men are known to be hardy and experienced mountaineers, extraordinary rescue measures are seldom found necessary; such men have a habit of showing up.

So, while the past winter, so far as concerned the men of "Pacific Service" in the

mountain fastnesses, had its hardships, its dangers and, sometimes, its scares, no serious results were reported. "Pacific Service" was maintained throughout. Many a deed amounting almost to heroism was performed, but it was all a part of the job.

Interesting data concerning the storm records in the mountainous regions of our "Pacific Service" territory are contained in recent communications from men in charge of reservoirs and power stations. Among these men a prominent figure is Harry Merema, lake tender at Strawberry and Relief, two reservoirs in the Sierra Nevada mountains northeast of Sonora which are the main sources of water supply for the hydro-electric system formerly owned and operated by the Sierra and San Francisco Power Company, now and for the past five years a part of "Pacific Service."

Relief reservoir is situated some 60 miles by road from Sonora, within ten miles of that Sierra summit which is crossed by the Sonora Pass on the old Mono highway. It lies 7200 feet above sea level. Strawberry, thirty miles by road below Relief, lies 5400 feet in the air. It is a region of hard traveling in winter time, and Merema is the ideal mountaineer. He is a sturdy Norwegian, more at home on skis than upon any other means of convey-



Harry Merema repairing 'phone line at Cow Creek.

ance. Two winters ago he came into special prominence through his rescue of the Nightingale party from a lonely cabin near Niagara, 45 miles from Sonora, after a thirty-mile trudge through deep snow.

"The season of snowfall started about the usual time," writes Merema. "By November 15th the mountain roads above Strawberry were closed to traffic. Heavy snows throughout the winter caused considerable damage as well as delay through slides, washouts and snowjams in ditches and flumes and on the transmission lines, both power and communication being temporarily out.

"The house at Philadelphia ditch looked like an Eskimo igloo. One kept one's snowshoes on and slid through a small hole beneath the porch roof to the door. At Strawberry dam one could stand outside on the snow and look into the attic. A bump in the highway near Niagara, if dug out, would have revealed a road-grader. Stairways were shoveled out in the snow leading to the cabin doors at Relief dam and Bone Springs, while the spring at Relief dam was 16 feet below the surface and had to be dug out every time it stormed.

"The first readings taken on the co-operative snow surveys of the State of California showed an average of 21 inches of snow and



Taking the Relief dam snowcourse with a 15-foot sampling tube.

4.1 inches of water at Strawberry on November 27th; 25 inches of snow and 5.2 inches of water at Niagara Flat on November 28th; 24 inches of snow and 5 inches of water at Relief dam on November 30th. The heaviest storm of the season was in the latter half of December. This ran depths of snow and water content up considerably, so that in the first week of January Strawberry showed 58 inches of snow and 17.6 inches of water, Niagara Flat 74 inches of snow and 22.7 inches of water, Relief 74 inches of snow and 23.9 inches of water. At Strawberry on January 29th the snow depth was 61 inches, the water content 19.8 inches. In the last week of February Strawberry showed 64 inches of snow, 27.1 inches of water; Niagara flat 89 inches of snow, 38 inches of water; Relief dam 92 inches of snow, 40 inches of water.

"The December storm put the 'phone line from Strawberry to Relief out of order. Over 1000 feet of wire was used to repair the line from Strawberry dam to Cow Creek, a distance of five miles. The line beyond was buried and frozen under six feet of snow for eleven miles and it was impossible to back-pack enough coils of wire to do the necessary repairs. This caused delay in getting readings and reports from Relief, as all had to be turned in at Cow Creek, a distance of 28 miles, and all traveling was on snowshoes.

"The depth of the snow and water content during the next two months from 7000 feet elevation on down will decrease as the length-



Columbia ditch, near Sonora.

ening days will soon start melting some of the snow; but from 7000 feet elevation on up we will still gain in both depth and water content in March and probably some in April in water content. As there still are two more months to come with usually fair precipitation, no real estimate of the run-off can as yet be given, but it may approximately amount to 500,000 acre-feet for the Tuolumne District.

"The outlook for a heavy run-off is thus good."

The Feather River region experienced the heaviest snowfall of any section of our "Pacific Service" territory. A brief but graphic account of conditions there is furnished by T. D. Mansell, in charge of the hydro-electric system at Bucks Creek, on the north fork of the Feather River. Bucks Creek is the



Summer home, at foot of Patterson grade, under seven feet of raked snow.

newest of the three hydro-electric plants of the system formerly owned and operated by the Great Western Power Company whose properties were acquired by our company two years ago and are now merged in the "Pacific Service" system. Writing from his mountain retreat in the early part of March, Mr. Mansell stated:

"We have frozen assets here in plenty. I made a ski trip on January 12th to Bucks reservoir for a visit with the lake tender, K. P. Patterson, and his assistant, George Campbell. They have been isolated from the rest of the world from November 14th and look like remaining so until possibly May 15th of this year.

"Both men, as well as their good wives, are quite efficient on skis. Their homes are only about 150 feet apart but the snow has to be shoveled from the track after each fresh fall until now there is a veritable cut banked by nine-foot walls. Irrespective of weather conditions, they have to turn out to make a gate operation or patrol a feeder, as the case may be, when called. In addition to this, they have to take snow samples at three different places; one at Three Lakes, which is fourteen miles away; one at Mill Creek, five miles; and one at Haskins Valley, six miles distant. The Three Lakes trip involves taking a whole day to get there and another day to come back. They have to carry their snow-sampling equipment with them.

"There is considerable hazard entailed in making these snow-sampling trips. For instance, on February 14th, 1929, Mr. Patterson and his partner at that time, Mr. McQuatt, were on their way to Three Lakes,

when McQuatt slipped and plunged down the mountain side 200 feet. An act of Providence enabled him to catch onto the only bush in sight; otherwise he would have plunged several thousand feet down the canyon. After heroic efforts, Patterson got McQuatt back on the trail and to a cabin at Three Lakes, four miles away, and telephoned in for help. The following day two men from Storrie and three from Camp Rogers went in and brought him out over a narrow icy trail five miles to Belden, where he was put on a train and sent to San Francisco."

Mr. Mansell gave the following readings as showing the depth of snowfall during the past winter: At Three Lakes, February 1st, 180 inches; on March 1st, 204 inches; on February 1st, on the ground at Bucks reservoir, 234 inches.

Nestling among the giant peaks of the Sierra Nevada, within a short distance of the summit on the Truckee side, lies Lake Spaulding, controlling reservoir of our company's South Yuba-Bear River system. There are three power plants at Lake Spaulding, two located immediately below the dam and one on the north shore of the lake. L. R. Landsburg, foreman in charge, gives the following account of winter conditions:

"The first snow fell November 14th and the next day we had 30 inches on the ground, blocking the roads to the highway for the balance of the winter. December 29th we had 69 inches on the ground, 72 inches on January 6th and 121 inches February 1st. Our mail and supplies were hauled in by sleigh from Emigrant Gap, a distance of  $3\frac{1}{2}$  miles from camp. During a heavy storm this

is a very hard trip and many times a man is only able to bring in the mail. Everybody puts in a supply of provisions to last about five or six months, so that hauling over the snow is cut to the minimum.

"Everyone uses skis. The power-houses are about one mile from camp and sometimes it takes an hour to make the



Bucks Creek reservoir covered with 90 inches of ice-crusting snow.

trip. The operator has to make his own trail every time he goes out during a storm because his tracks are completely covered in an hour.

"During the greater part of this winter we were able to cross the lake over the ice. Patrolling of power and telephone lines is the greatest hardship, especially on the summit line which transmits power to the Sierra Pacific Power Company at Reno. Due to the fact that our company carries the entire load of its Nevada neighbor this line must be patrolled at once when trouble hits. On Drum canal and the South Yuba flume the men are sometimes out all night as well as all day to keep these conduits open."

Nine miles below Lake Spaulding, in a gorge of Bear River, lies Drum power-house, the controlling plant of the South Yuba-Bear River system. Mr. B. H. Wilcoxon, foreman in charge, writes:

"The heaviest snowstorm we had in November was quite wet and caused us line trouble. The storm that came at the end of January was very severe, with heavy winds of hurricane type. The road into the plant was drifted full from 4 to 7 feet deep and blocked for about 16 days. The weather remained cold and the snow was so crusted that we could walk anywhere upon its surface.



Lake-tender's house, Bucks dam—90 inches of snow on level.

"On February 2nd, one of the operators went out on skis and fell and cut his kneecap. He had to be carried in on a stretcher, with the men walking on snowshoes a distance of three-quarters of a mile. The next morning we built a sleigh and pulled him over the road for one and one-half miles, where we were met by a caterpillar tractor drawing a sleigh. It was a tough trip and required nine hours for the tractor to make the round trip of thirteen miles.

"We had some rather hard work in getting supplies for the cook house and the families. Most of the families had plenty on hand except of the perishable variety. These we caused to be hauled to the Drum camp road and carried from there a distance of one and one-half miles. Considerable work had to be done in keeping buildings clear of snow. The line workers had some hard days, but as

all hands kept well what hardships were experienced were soon forgotten."

Mention has been made of snow sampling to measure depth and water content. The apparatus consists of a hardwood pole on which is hung a scale which gives the direct reading in inches of water content in each sample of snow taken with the



Quincy-Oroville highway, near bridge over Bucks Creek, under 90 inches of snow.

sampling tube. This tube is in four five-foot sections, enabling the operator to use a sufficient number of sections to measure the snow; also making it easier to pack the apparatus along without damage. A bent tube could never pierce the successive layers of crust, nor could the weighed sample be removed from a dented tube. The outside of the tube is graduated in inches and the bottom of the first section has a steel cutter with an exact inside diameter of one and one-half inches to



Gauging station at Grizzly Creek. About 120 inches of snow on ground.

correspond with the graduations on the scale, making each point on the scale one inch of water content.

The empty tube, of necessary length, is first weighed on the scale and the pointer adjusted to zero. It is then pushed or twisted through the snow to the ground and the tube slowly extracted, taking the core out with it, and again weighed. This gives by weight the water content of the sample taken and the depth of snow, length of core and water content for record on the field notes.

The snow courses are selected by the State of California with the assistance of the Pacific Gas and Electric Company. There are two rows of samples, marked with signs at each end and at right angles to each other. They are located on open level meadows and usually consist of twenty samples fifty feet apart, to get an accurate average of depth of water content.

In this way is "Pacific Service" maintained during the winter season in the regions of heavy snowfall.

If it were not for the dams put in to furnish hydro-electric power and water for irrigation and domestic use, a heavy snowfall like this winter's would do millions of dollars' worth of damage to property when the run-off starts. The reservoirs of the Pacific Gas and Electric Company and irrigation districts not only serve to store water but also, according to their capacity, act as flood control reservoirs protecting the lives and property of residents in the valleys.

F. S. M.



Patrolman on Spaulding-Reno line near the summit. He took 40 minutes to travel 150 yards.

# Warehouse System for Storage and Distribution of Supplies

By F. P. HANSON, *Manager Purchases and Stores Department*

Storage and distribution, combined with the control of and accounting for the material and supplies of the Pacific Gas and Electric Company, comprise an undertaking of greater magnitude than is realized by but few of the company's consumers or persons outside of its own organization. Some idea of the volume of this business is contained in the statement that more than \$20,000,000 of material was received and disbursed during the calendar year of 1931.

The Stores Department, which is charged with this responsibility, is headquartered at the town of Emeryville, on the east side of the bay of San Francisco, between the cities of Oakland and Berkeley.

Over 275 persons are employed at this location, while approximately 175 additional employees are located in various other sections of the "Pacific Service" territory, carrying out similar work on a smaller scale in sub-stores or warehouses.

The headquarters of this department, known as the Central Warehouse, is situated on 12¾ acres of land, on which are erected,

besides the main warehouse building, a metal shop, forge and wood-working shop building, and a foundry and salvaged metals building. This group of buildings are all of Class "C" heavy mill-type construction, with concrete walls and timber frame. All are one-story structures with the exception of the warehouse building, which has a center section of two stories.

The main warehouse building extends 600 feet north and south on Hollis Street, Emeryville, with a depth of 130 feet. The main floor, of concrete, is elevated to truck-bed level, and is used for the receiving, storing and shipping of materials. Large rolling doors on the Hollis Street, or east side, permit the entrance of three trucks at either end of the building, while the entire west side is served by a depressed spur track, extending to the full length of the property, and establishing rail connection with the track and switching facilities of the Santa Fe, Sacramento Northern, Southern Pacific and Western Pacific railroads. Local and transcontinental carload shipments over any of these roads are brought



General view of the plant at Emeryville.

direct to the warehouse door.

The second story, mid-section of the warehouse building, is 70 feet wide and extends back over the full width of the warehouse building, or 130 feet. It is occupied by the executive and accounting offices of the Supply Department.

The machine and electric utility shop building is located on the west side of the spur track, occupying the south-west corner of the property, and extends north and south 264 feet, with a depth of 108 feet, which area is divided into two main sections of equal size. The southern section, or electric shop, is used for the repair of transformers, motors, generators, voltage regulators, etc., and a modern 20-ton overhead electric traveling crane is available for the depth of the building. The northern section, or machine shop proper, is equipped with individually motor-driven lathes, drills, shapers and milling machines of



General view of interior of warehouse.

the most modern type, which are capable of turning out precision work, either large or small, with dispatch. This section is similarly provided with its electric traveling crane.

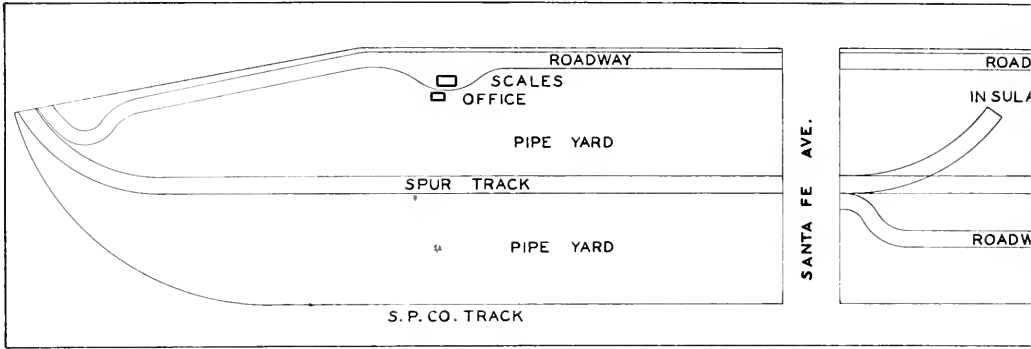
To the north, a building paralleling the railroad track for 120 feet and having a depth of 80 feet accommodates a forge shop in which is done the electric and acetylene cutting and welding, forge work and sheet metal work. In this building, also, is located the pattern shop, which provides for casting

pattern work, general carpenter work and crate-making for shipping storage.

Again to the north, a building paralleling the track for 220 feet and with a depth of 60 feet, houses in the southern third of its area foundry equipment for the production of non-ferrous castings, such as brass, copper and aluminum, as may be required of spe-



Exterior of main building.



Plan of the Pacific Gas and Electric Company's Central Warehouse

cial composition for the repair of the company equipment. The central or one-sixth of building area is used as a cafeteria, where employees may obtain a hot luncheon at a nominal cost; and the northern one-half of the building area is used for the sorting and storage of non-ferrous metals.

The northernmost section of the property, comprising an area of  $4\frac{1}{4}$  acres, is used for the storage and soil-proofing of gas and water pipe. The pipe is brought to the yard in car-load lots and is there coated and wrapped with specially prepared paper before being issued to the departments of the company for installation and maintenance of gas mains and consumer service. During the year 1931 a quantity of over three and a half million feet of pipe of various sizes was handled and shipped from this yard.

All buildings are protected with an automatic sprinkler fire system, directly connected to a fire pump, delivering 750 gallons per minute at 100 pounds pressure, and is also connected to the city water mains. This system is augmented by hose lines, carts and fire extinguishers, thus assuring ample protection at all times.

The remainder of the property

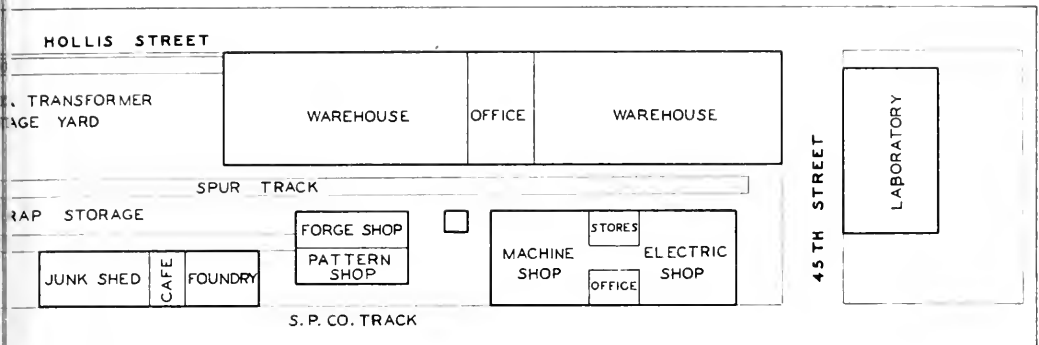
not occupied by building and spur track is used for the accumulation of scrap-ferrous metals and for the storage of outdoor transformers, high-tension insulators and other material which does not require protection from the weather.

The headquarters group, or Central Warehouse, as it is commonly known, controls all of the material and supplies for the Pacific Gas and Electric Company, and this control functions through more than 200 sub-warehouses, distributed at strategic points throughout the company's territory.

The Supply Department may be compared to a water system, the main reservoir of which is the central warehouse, into which the material is brought from the various sources of supply and then distributed to the points of requirement through the sub-stores.



Part of electric shop. Test room for transformers.



house plant at Emeryville, Alameda County, California.

The Central Warehouse organization at Emeryville is charged with the responsibility of keeping this channel open and functioning properly, in order that the material on hand will be adequate at all times but not excessive.

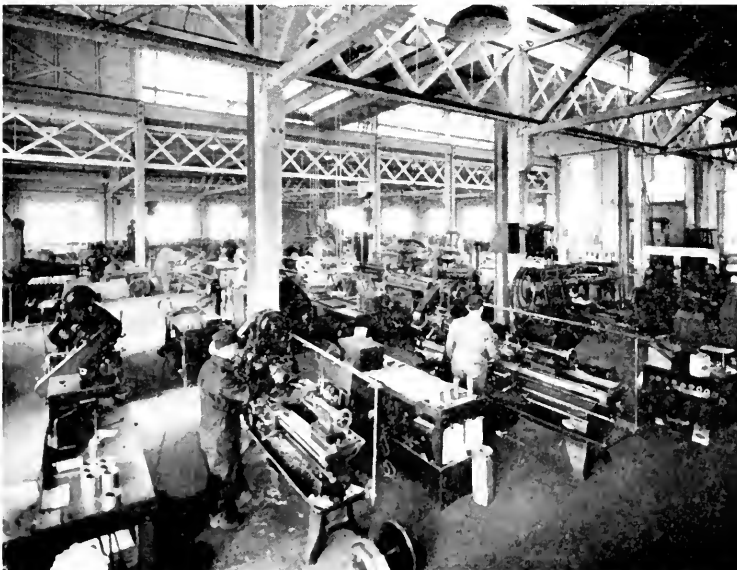
The supply of material on hand is replenished through the Purchasing Department and the wants are made known to them by means of purchase orders prepared by the Central Warehouse. It is the company's policy to purchase materials from California manufacturers wherever possible, thus saving time and freight charges as well as helping maintain and encourage local industries which furnish employment to people of all trades and vocations, who, in turn, are users of this company's commodities. Not all of

our purchases, however, are confined to California firms, for we must extend our sources of supply to the Pacific Northwest for poles, to the Atlantic Coast for certain electrical equipment, large pipe, etc., and to the mines of Montana for our copper wire.

All of the goods handled by the Supply Department are not necessarily new, since the department also acts as an accumulating point for materials and equipment from plant retirements, such as may have been damaged in operation or proven inadequate in their present location and requiring replacement with something of a larger or more efficient type. Such material is turned over to the shops where motors may be re-wound, transformers rebuilt or converted to a more

modern type, and switches repaired, and reconditioned, then to be stored in the warehouse to await future demand.

A force of trained men is required in the shops and foundry to repair and rehabilitate this returned material and equipment. All non-ferrous junk material is also turned in from different points on the system and accumulated at Emeryville until such time that the mar-



Machine shop.

ket is most favorable for its sale.

Aside from the physical side of this work, there is another phase which is essential, in fact, indispensable to the control and proper functioning of the Supply Department. This is the Stores Accounting Department, which is located at the Central Warehouse, and it is to that department that all requests are referred for materials necessary to replenish the various stocks. The Central Warehouse may fill such requests from its stock; it may be drawn from another sub-store, possibly transferred from store to store or purchased directly from an outside firm through the Purchasing Department.

All transactions recording the withdrawal or return of material from the Central Warehouse and its sub-stores are passed through this accounting department. In this manner it is informed of the material purchased for each store, the transfer from the Central Warehouse stock to that of another sub-store, the transfer between sub-stores and the material withdrawn or returned to each sub-store. This information is compiled and posted in a stock record for ready reference and shows the value, quantity and location of each article of material carried in stock.



Copper wire and cable storage warehouse.



Steel-bin storage for small parts.

Normally, this stock consists of between 55,000 and 65,000 different articles, and over 300,000 stock cards are required for recording the necessary information.

This department also furnishes the various company divisional accounting departments each month with a detailed report of material charges to jobs and accounts, and also the management officials with a concise statement of the materials purchased and disbursed, together with the balance on hand each month. Rendering these reports and maintaining the stock records involve recording over a half-million transactions each month, representing normally a turnover of from \$1,500,000 to \$2,000,000 of material monthly.

The accuracy of the stock records is verified by inventories, taken monthly, of special materials such as incandescent lamps, appliances carried for resale, etc.; for all other material these inventories are taken throughout the year, so scheduled that each sub-store is inventoried at least once a year. The checking of the inventory, the tracing of discrepancies and the adjustment of the stock records are made by the General Auditor's representative who is in every way responsible to the Supply Department.

## California's Redwood Empire— Truly a Land of Opportunity

Following the coast line north from San Francisco and extending beyond the State border line to Grants Pass, Oregon, stretches a vast tract of territory to which has been given the name "Redwood Empire."

In addition to San Francisco, this picturesque region embraces seven counties of the State of California, Marin, Sonoma, Napa, Lake, Mendocino, Humboldt and Del Norte, and one Oregon county, Josephine. In a stretch of over 500 miles, measuring north to south, it is bordered by the Pacific Ocean on the west and, on the east, by the higher slopes of the Coast Range. It has

been given its name because within this territory, in all its majesty, is to be seen in profusion the stately redwood, that giant of the forest which is indigenous to California, grows only on the coast and, with its age estimated as running into thousands of years, is one of the mysteries of the arboreal world.

The region is widely advertised as "Amer-



View in the Napa Valley. Mt. St. Helena in the distance.

ica's newest national playground." It is more than that. In addition to its natural wonders of interest to the sightseer and its attractions of scenery and climate that appeal so strongly to the summer vacationist, it possesses a wealth of natural resources which makes it a veritable land of opportunity for the permanent settler. For, it is not all sea-coast and

forest. It includes spreading, stream-fed valleys thriving under dairy-farming, poultry and stock-raising and various forms of agriculture, including the fruit culture which has given it fame far beyond the confines of our State. It possesses bustling communities of sound commercial standing and industrial centers favored by the



Summer on the Russian River, Sonoma County.



The Mission of San Francisco de Solano at Sonoma.  
Established in 1823. Restored in early years.

propinquity of the raw material, climatic conditions agreeable to labor, adequate transportation facilities and industrial sites innumerable. It is also rich in mineral deposits and many of these are being worked to considerable advantage.

Only a comparatively few years ago the northern counties of this great stretch of ter-

ritory were looked upon as an almost inaccessible hinterland. Today, by reason of extended railroad facilities and up-to-date highway construction, the Redwood Empire is coming into its own. Incidentally, "Pacific Service" is playing a not inconsiderable part in the work of development, for our company's network of electric transmission and distribution lines extends from San Francisco north along the coast route as far as the limits of Mendocino County, while the Humboldt County end of the chain is supplied with hydro-electric power through a high-tension line running east from Redding to Eureka, where also there is a steam-electric plant. In addition, cities and towns in a considerable portion of the territory enjoy gas service.

At the north portal of the Golden Gate which marks the entrance to the harbor of San Francisco lies the Marin peninsula, southern terminal of the northern coast highway. The beauties of Marin County are well known to most of our readers. With its wooded hills, its fern-grown canyons, its flowering meadows, its sheltered coves, its genial climate, it possesses attractions second to no county of the State. It is known as the commuters' paradise, for it is dotted with picturesque home-sites, all within an hour's run by boat and train from San Francisco. Sausalito, Belvedere and San Rafael are among the most popular residential communities, for they have the advantage of bordering upon the bay, but there are others within easy distance of equal charm. An



Scene at the old Sonoma Mission,  
reminiscent of Spanish California.

historical landmark is Mt. Tamalpais, majestic sentinel of the Golden Gate, towering 2,592 feet above sea-level, highest eminence in the bay area. On one side of the mountain lie the Muir woods, named in honor of the late John Muir, famed naturalist. The woods, a gift to the nation, comprise 425 acres of virgin redwoods.



Apple-packing plant at Sebastopol

On the sea-coast at the foot of Tamalpais are several beaches, prominent among which is Bolinas, where there are many summer homes. Still farther up the coast is Tomales Bay, noted for its fishing stations. From there Drake's Bay, where the *Golden Hind* is said to have anchored, can be reached by road.

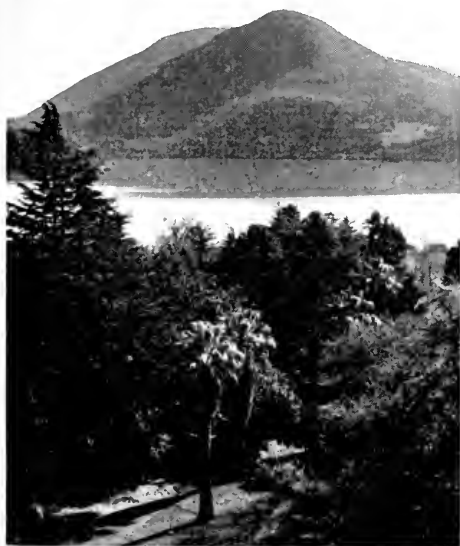
San Rafael is the county seat of Marin. It is a prosperous, growing community, with fine stores and beautiful residences. It marks

the northern terminal of the interurban electric railway system which connects with the ferries to San Francisco.

In addition to its physical attractions, Marin County is a thriving agricultural center. The county's dairying interests are of outstanding importance, the San Francisco bay area depending largely upon Marin for its supply of milk, butter and cheese.

Just north of Marin is Sonoma County, rich in agriculture and full of historic interest. The fruit-growing districts around Santa Rosa—county seat—Healdsburg and Sebastopol are famous, the Santa Rosa and Healdsburg districts, particularly, for prunes and the Sebastopol region for Gravenstein apples, the earliest on the market. Vineyards, too, flourish particularly well in the Sonoma and Russian River valleys, thriving upon the gently sloping hillsides. Sonoma County, also, is one of the most important berry-growing districts, supplying many of the Eastern as well as the home markets with the early product.

But it is for its egg industry that Sonoma County holds special prominence. It is responsible for at least one-third of the egg production of the entire State of California. Petaluma, the second city of Sonoma, is known as the world's egg basket. There are seven egg-packing plants in operation at Petaluma and two in Santa Rosa. An average of over one million eggs a day pass through the largest of those plants. Around the countryside are chicken farms galore, said to number 3000, and the hatcheries,



Clear Lake, Lake County, with Mt. Konockti, extinct volcano, in the background.

where artificial light is used to lengthen the day for the laying hens during the winter months and electric incubators aid production, are outstanding examples of modern industrial progress.

By way of historical interest, the flags of seven nations have been flown to the breeze over Sonoma since the first white man trod the Western shores of America and many thrilling incidents of California's early history occurred within the borders of that county. A conspicuous incident was the raising of the Bear Flag by the party of that name in the old city of Sonoma in 1846. There, too, stands the old Mission San Francisco Solano de Sonoma, the last link in the chain of missions established by the padres from San Diego north toward the close of the eighteenth century.

A souvenir of the Russian occupation is Fort Ross, on the coast of Sonoma north of the Russian River. The old Greek church built by the Russians in 1812 still stands, together with the stockade and blockhouses of the settlement surrounding it.

Sonoma County is full of scenic attractions. One is the Valley of the Moon, so christened by Jack London, beloved novelist, who made his dwelling there and produced

many of his literary masterpieces. Then there is the Russian River, with its winding beauty and its numerous pleasure grounds. On this river, within a few miles of the mouth, is located the world-famed Bohemian Grove. Sonoma also boasts of petrified forests, where fallen redwood giants turned to everlasting stone prove a source of amazement to the layman visitor and a fruitful study to the man of science. Another source of wonder is found in the spouting steam geysers, which attract many visitors from afar. Santa Rosa has enduring fame as the home of Luther Burbank, and the Burbank gardens, where the wizard's experimental work is still kept up, attract scientists and others from all parts of the world.

East of Sonoma lies Napa County. The Napa and Sonoma valleys almost parallel



Former Snow Mountain, now Pacific Gas and Electric Company's hydro-electric plant in Potter Valley, near Ukiah, Mendocino County.



Lake Pillsbury, power reservoir in the Eel River canyon.

each other, being divided by a range of foothills. Here, too, agriculture is the outstanding industry. Dairying, poultry and stock-raising are profitable enterprises, but the county is best known for its spreading orchards and vineyards, while a large section is devoted to the production of alfalfa, barley, corn, hay, oats, wheat and vegetables. Napa, the county seat, is an Old World



Numerous giant lumber mills are in operation in the counties of Mendocino, Humboldt and Del Norte.

community much modernized, with active commercial and manufacturing enterprises and beautiful homes.

Napa's scenic attractions lure visitors. Few parts of California are more beautiful. There are some native wonders to be seen, notably the natural water geysers at Calistoga. Some of these shoot as high as 300 feet in the air, spouting at regular intervals of from 30 minutes to 3 hours. There are groves of redwoods on Mt. Veeder, an extinct volcano,

where Robert Louis Stevenson once made his home and where he wrote "Silverado Squatters," and on stately Mt. St. Helena, another eminence from whose crest, thousands of years ago, belched fire, smoke and ashes. The "Silverado" trail winds up the mountain to the monument erected to the memory of Stevenson upon its summit.

Lakes and streams are stocked with trout and the hills teem with deer and quail. Duck-shooting is to be had in the marshes and sloughs. Summer resorts and camps abound throughout the county. Curative mineral springs are everywhere.

Lake County has been styled "The Switzerland of America." It possesses an attractive chain of lakes, the largest of which is Clear Lake, a broad sheet of water 28 miles long and 9 broad. It is extremely picturesque. Pleasant homes are dotted around it and a resort, Lucerne, boasts a spacious hotel. It is only of late years, however, that agriculture has been prosecuted to any extent on its borders. Available electricity has worked the charm and pear orchards



Trout fishing is good sport in the Eel River.



One of the many giant trees to be found along the Redwood Highway.  
Estimated age, 3000 years.

now bloom where once there was untilled soil. Reclamation projects are in progress. Fruit culture in other sections of the county is of an older date—the Lake County pears are among the finest grown in the State—and there are spacious ranges tenanted by fine livestock. There are quick-silver deposits in that region, the Sulphur Bank mine, on the border of Clear Lake, being a prominent and successful enterprise.

Here is a veritable playground. Hills and valleys teem with resorts and there is excellent hunting in the mountainous sections. Lake County was hindered in its development for many years through lack of rail or even adequate road transportation facilities, but about ten years ago the first State highway was constructed and now there are highway approaches from all directions. Lakeport, the principal town, is located at the western end of Clear Lake and under the improved conditions is assuming a status of importance.



Giant redwoods of Humboldt County, thousands of years old.

To the west and north of Lake County is the county of Mendocino. Here the giant redwood begins to make its presence known to great advantage. There are thousands of acres of these trees, many groves bordering on the scenic coast highway. Mendocino County is noted for its lumbering industry, carried on chiefly along the coast, where a number of large mills are in operation. The county is also famed for its spacious ranges, well stocked with cattle and sheep. The Hereford is the popular breed of cattle, range

and climatic conditions being best adapted to it. Dairying is also carried on to a large and profitable extent. Agriculture is active in the valleys, and among the prominent outputs are orchard products, grapes, field crops and alfalfa. Alfalfa is grown in northwestern California almost entirely without irrigation, whereas



Model dairy farm in the Eel River valley, Humboldt County.

in the State's central valleys it is produced mainly in irrigated areas.

Mendocino is noted for the picturesque charm of its open spaces and rugged scenery. An outstanding feature is the spectacular Eel River canyon, traversed by the Redwood Highway. Indian life still abounds in the county and the Round Valley reservation is a point of interest largely patronized by tourists. Ukiah, on the line of the Northwestern Pacific, running between Sausalito, on San Francisco Bay, and Eureka, Humboldt County, is the county seat of Mendocino.

North of Mendocino lies Humboldt County, with its sea-coast, its redwood forests, its lumber mills, its dairying, its stock-raising and its agricultural activities. Lumber is its principal industry, its standing timber and mills representing an investment of hundreds of millions of dollars, while the redwood manufacturing plants furnish employment for thousands of workers. But there are other industries of importance. Dairying, for instance. The first creamery in California was established near Ferndale, twenty miles south of Eureka, and this region has always more than held its own. In the lowlands of the Eel River and Mad River valleys one acre is often sufficient to maintain a dairy cow and yield per head is very high.

Around Eureka and its neighbor, Arcata,



Scene from the Coast Highway  
in Del Norte county.



Looking into the River Styx, Oregon Caves  
National Monument.

an important poultry-raising district has been developed. Green feed is available in every month of the year, an important consideration in low-cost egg production. Fruit-growing flourishes, also. Humboldt County has made great progress in the production of berries of all kinds, land upon the "benches" a short distance back from the coast having proven ideal for the cultivation of these small fruits.

Eureka, the county seat of Humboldt, is located upon Humboldt Bay. It possesses a harbor of importance which will accommodate ocean-going vessels of as much as 30 feet draft. According to recent U. S. Government figures, its annual water-borne commerce reaches approximately \$25,000,000. Eureka is also the center of woolen manufacture in California. The Eureka Woolen Mills is an enterprise known far and wide.

The scenery of Humboldt County is marvelous in its varied grandeur. From its southern border to the Eel River valley the Redwood Highway winds through grove after grove of majestic redwoods. And, so

far as the groves bordering upon the highway are concerned, there the timber-cutter comes not. Wealthy nature-lovers have purchased those groves in sections and by dedicating them to the public cause have preserved them in all their glory for all time. Then follows the pastoral beauty of the Eel River valley, glowing by contrast. Eureka brings the traveler back to the rock-bound coast.

Del Norte, California's most northerly coastal county, rivals Humboldt and Mendocino in its redwood forests. The 100-mile stretch of highway from Eureka to Crescent City, the county seat of Del Norte, runs through an apparently interminable succession of groves along the rocky ridge that skirts the coast. The county enjoys no railroad facilities, but Crescent City boasts a harbor that will accommodate vessels of moderate size, and improvements are in progress that will considerably enlarge its capacity.

Dairying, fruit-raising and the production of alfalfa, hay and grain are rapidly supplanting in importance the lumbering industry that was for years Del Norte's main source of revenue. The tourist and resort trade also flourishes. The county's principal streams, the Klamath and Smith rivers, offer rare sport to the disciples of Isaac Walton, while deer, bear and other wild game abound in the mountains around Crescent City.

Mention should be made of the various fisheries along the California coast north of San Francisco which constitute another source of permanent wealth. Salmon, halibut, perch, smelt, whitebait and steelhead are among the varieties of fish taken. Humboldt County crabs are famous.

Crossing over into Oregon, Josephine County is a region of diversified industries, including mining, lumbering, stock-raising and agriculture. But the county boasts chiefly of its scenic attractions, most enthralling of

which are the Oregon caves, or "Marble Halls of Oregon," as they are sometimes called. Recently designated as a national monument, these caves, situated 50 miles south of Grants Pass, extend hundreds of feet into the heart of Elijah Mountain, 4000 feet above sea-level. The chambers resembling vast auditoriums, are of marble, adorned with vast stalactites and stalagmites which scientists declare have been thousands of years in forming.

The Rogue River is the favorite fishing ground of Zane Grey, the novelist. Grants Pass, the county seat, is a bustling city, central shipping point for a rich agricultural area. There the Redwood Empire finds its northern boundary.

It has been stated that northwestern California abounds in mineral products. Quick-silver, manganese, sulphur, borax, copper and gold are among the minerals offering opportunities for exploitation. There are known coal deposits in various parts of the territory and petroleum indications are numerous in Humboldt. Natural gas has been found in the counties of Humboldt, Lake, Sonoma and Marin. Development of these various resources on a large scale, however, is yet to come.

Water-power is an asset of vast importance in the industrial expansion of the territory. The ample rainfall assures a large run-off annually and the waters have been stored and controlled for the use of man. Hydro-electric energy offers cheap and dependable power.

The foregoing may be regarded as a mere sketch of this attractive region. More space than is available at the present time would be required to do it justice. It must be seen to be appreciated. It is destined to meet much popular favor.



# The Financial Side of "Pacific Service"

Following is a consolidated statement of Pacific Gas and Electric Company's income account, including all subsidiary and affiliated companies, for the three months ended March 31, 1932, compared with the same period of the preceding year:

## PACIFIC GAS AND ELECTRIC COMPANY AND SUBSIDIARIES CONSOLIDATED INCOME STATEMENT, THREE MONTHS ENDED MARCH 31ST

	QUARTER ENDED MARCH 31, 1932	QUARTER ENDED MARCH 31, 1931	+Increase —Decrease
Gross Revenue, including Miscellaneous Income.....	\$22,402,979	\$21,566,176	+\$836,803
Maintenance, Operating Expenses, Taxes (including Federal taxes) and Reserves for Casualties and Uncollectible Accounts.....	9,897,367	9,168,139	+ 729,228
Net Income.....	\$12,505,612	\$12,398,037	+\$107,575
Bond Interest and Discount.....	4,018,050	3,922,014	+ 96,036
Balance.....	\$ 8,487,562	\$ 8,476,023	+\$ 11,539
Reserve for Depreciation.....	2,887,395	2,712,728	+ 174,667
Surplus.....	\$ 5,600,167	\$ 5,763,295	—\$163,128
Dividends on Preferred Stock.....	2,005,518	1,979,543	+ 25,975
Balance.....	\$ 3,594,649	\$ 3,783,752	—\$189,103
Dividends on Common Stock.....	3,118,143	2,858,189	+ 259,954
Balance.....	\$ 476,506	\$ 925,563	—\$449,057

Earnings for the first quarter of 1932 were equivalent to 58 cents per share on the total common stock outstanding at the close of the quarter. This is 7 cents per share less than in the corresponding quarter of last year.

The chief factors which influenced the quarter's business were: (1) A decline in electric gross, due chiefly to reduced industrial and agricultural power demands, reflecting, in turn, the present unfavorable economic conditions, and, in the case of agriculture, a lesser need for pumping than in the drought year 1931. Retail outlets, such as lighting, heating and cooking, show fair increases over the preceding year, but declines have taken place in all branches of power service. The poorest showing is being made by the San Joaquin System which shows a drop of more than \$250,000 in electric gross since January 1st. (2) Increased costs, due to larger deliveries to us of power under contracts with other producers who were compelled to curtail deliveries last year owing to drought conditions. (3) Increased purchases of natural gas to meet growing utilization for domestic and industrial purposes. Consumption is increasing at a fair rate, but will undoubtedly proceed more rapidly when and as public purchasing power is restored. (4) Increased taxes of \$144,000. (5) Added charges on new capital invested in facilities not now fully employed due to the business depression. These added facilities enabled us to avert a serious power shortage in Northern and Central California last year, and it is interesting to observe that an increase of only 2½% in electric gross would offset the added interest and dividend charges of \$382,000.

The Company's current financial position, with a cash balance of \$20,000,000, is excellent. Our construction activities are, and for the remainder of the year will undoubtedly continue to be, of a routine character and can probably be almost wholly financed out of current reserves and without reducing working capital. While we might wish that this were otherwise, it will obviate the need of any new financing until the demands upon our services again increase.

There is in my judgment no occasion for stockholders of the Pacific Gas and Electric Company, either preferred or common, to have any doubts about the continuance of dividends.

### OWNERSHIP OF COMPANY'S SECURITIES

At the close of 1931 the outstanding stock of this Company and its subsidiary, the San Joaquin Light and Power Corporation, was held by 94,021 investors, of whom 77,219, or 82.1%, were residents of California. The following summary shows the distribution of ownership of each class of stock:

#### SUMMARY OF STOCKHOLDERS

CLASS OF STOCK	IN CALIFORNIA	OUTSIDE CALIFORNIA	TOTAL
Pacific Gas and Electric 1st Preferred 6%.....	29,119	4,975	34,094
" " " " 1st Preferred 5½%.....	18,622	1,149	19,771
" " " " Common.....	20,669	10,171	30,840
San Joaquin Light and Power Stock.....	8,809	507	9,316
Total.....	77,219	16,802	94,021
% of Total Stockholders.....	82.1%	17.9%	100.0%

In addition to the very large number of holders of the Company's stocks, its bonds, of which \$308,755,400 were outstanding at the close of 1931, are also distributed among many thousands of investors. Complete statistics as to the number of the Company's bondholders cannot be secured. However, ownership certificates filed by individual bondholders in connection with the payment of Federal income taxes indicate that \$113,608,000 par value of bonds, or slightly more than one-third of the total outstanding secured obligations, are held by 36,678 investors. The remaining \$195,147,400 of bonds, concerning the ownership of which detailed information is not available, are held chiefly by insurance companies and other institutional investors; these holdings in turn representing funds invested by these institutions for the benefit of a vast number of policyholders and others having a financial interest in such investments.

The following summary showing the ownership of all securities concerning which information is at hand indicates a preponderance of women investors in both stocks and bonds:

	STOCK (P. G. & E. only)		BONDS (P. G. & E. only)*		TOTAL	
	Number	Average Holdings	Number	Average Holdings	Number	Average Holdings
Men.....	31,013	\$ 2,200	14,011	\$2,800	45,024	\$ 2,400
Women.....	35,062	1,700	16,746	2,700	51,808	2,000
Joint Tenants (usually husband and wife).....	15,685	1,600	155	4,400	15,840	1,600
Institutional Holders, Trust Estates, Associations, Partnerships, etc.....	2,945	40,000	5,766	4,900	8,711	16,800
Total.....	84,705	\$ 3,200	36,678	\$3,000	121,383	\$ 3,200

\*Where details available from ownership certificates.

# Pacific Service Magazine

PUBLISHED QUARTERLY IN THE INTERESTS OF  
PACIFIC GAS AND ELECTRIC COMPANY

FREDERICK S. MYRTLE · EDITOR-IN-CHIEF

PACIFIC GAS AND ELECTRIC COMPANY  
245 Market St., San Francisco

*The Pacific Gas and Electric Company desires to serve its patrons in the best possible manner. Any consumer not satisfied with his service will confer a favor upon the management by taking the matter up with the division headquarters.*

VOL. XVIII      APRIL, 1932      No. 8

Recently the question, "Why should not utility rates decline in proportion to falling commodity prices?" is one that many consumers have asked. It is a fair question and a very natural inquiry under present conditions. To answer the question requires pointing out some of the fundamental differences between public utility business conducted under a system of state regulation and private business enterprise.

Under California Railroad Commission regulation, utilities are prevented from charging more for their service than will provide a reasonable return upon a fair valuation of their properties devoted to public use. On the other hand, unregulated industrial and commercial enterprises are free to charge for their products and service all that can be obtained. The upper limit to their price, and consequently to their profits, is determined by the law of supply and demand.

The regulation of rates and the control of a fair return on investment, in the case of regulated utilities, are exercised to the end that rates, at all times, be maintained at a reasonable level. Since utility regulation does not permit them to earn more than a fair return during prosperous times, it obviously follows, and it is manifestly just, that their rates and their rate of return must not be unfairly reduced during a period of business depression. The same regulatory standards upon which they were judged during good times must be observed during bad times.

It is obvious, therefore, that public utilities cannot be subjected to the sharp price fluctuations incident to private business. During the period of prosperity following the war and up to two years ago, public utilities

throughout the land were reducing their rates. These frequent reductions resulted in lowering their receipts to the basis of cost. At no time were any excessive earnings allowed or realized. The utilities came up to the depression period with their rates already cut to a fair return basis, and are now in the position of having no available rate margins or excessive returns to pass on to their consumers.

It is true that the declining cost of material and labor results in lowering utility operating expenses. Such expenses, however, represent the smaller part of the total costs of a utility company. Utilities turn their capital over once in every five to ten years. The average is probably between six and seven. Commercial and industrial enterprises turn their capital over once to several times each year. Therefore, fixed charges, interest, depreciation and taxes are much higher for utilities, and represent the bulk of the total annual costs of conducting the business. They cannot be reduced during periods of smaller output and sales. At least one element—taxes—keeps on increasing regardless of the trend of output and sales.

The other costs, covering labor and material expenditures, less than half of all the costs, obviously do not afford the opportunity for the same proportion of reduction of total operating costs resulting from the decrease in commodity and labor prices as applies in the cases of practically all private enterprises. Due to the very large proportion of total cost represented by fixed charges, the utilities' total cost of operation has been affected to a lesser degree by declining prices of material and labor than unregulated commercial enterprises.

While regulated public utilities have to some degree been benefited by the price decline of the last two years in their operating material and labor expenditures, such lesser costs have been absorbed by the decline in receipts brought about by reduction in the demand for service. Most people overlook the fact that during this depression the utilities, too, have lost considerable business and, consequently, their revenues have fallen off, although their plant investment is continually increasing.

There is another important difference between public utilities and private business in times such as these. Private business ceases to borrow money, cuts expenses to the bone and, if necessary, even closes up shop and awaits

the return of more prosperous times. Public utilities are limited in the extent to which they can go in making economies. They are obligated to continue to serve and render adequate service at any and all times.

Statistics issued by the U. S. Bureau of Labor upon the trend of the cost of living are calculated upon a basic index of 100 for the year 1914. A comparison of the San Francisco cost of living index with that setting forth the prices of domestic gas and electricity, all based on the year 1914 as 100, reveals that gas and electric rates have always been much lower. Subsequent to 1914, the cost of living began to increase materially. At its peak the cost of living index was up to 196. The corresponding peak for gas rates in San Francisco was only 124 and for electric rates, 130, compared with the year 1914 as 100, these increases in the sale prices of gas and electricity being very materially less than the additional operating costs incurred by this company.

From shortly after the peak price period in 1920 to about 1929, the cost of living index hovered around 160, or 60 per cent over the basic 100. During this period, electric and gas rates were constantly being reduced. In the last two years the cost of living receded sharply, but as of December, 1931, it was still 38 per cent above pre-war levels. At the same date our company's domestic gas rates were 37 per cent below and our domestic electric rates 17 per cent below pre-war levels. The data for San Francisco are also generally applicable to the company's entire system.

The various items entering into the cost of living index all reached a much higher point during the peak price period than did the cost of gas and electricity. They are still much above the cost of gas and electricity. They are still much above the base index of 100, even at this time. Today the domestic consumer is paying 37 per cent less for gas and 17 per cent less for electricity than he did before the war period, but for his other household costs he is paying more.

The P. G. and E. rates today are among the lowest in the country. A recent publication of the Public Ownership League of America, Bulletin No. 62, gave the cost of 50 kilowatt-hours domestic use per month in 100 representative cities operating under municipal ownership. In 79 cities the monthly bill was higher than for San Francisco.

The company has reduced its electric and gas rates several times during the past ten

years. The average selling price of electricity to domestic and commercial consumers, for example, decreased from 7.02 cents per kilowatt-hour in 1921 to 4.29 cents in 1931, a reduction of 63.5 per cent. Putting the matter in another way, the company now has to sell 23 kilowatt-hours to these classes of customers to produce the same dollar of revenue derived from selling only 14 kilowatt-hours in 1921.

It is conservatively estimated that the savings to our consumers during the past decade, resulting from rate reductions and the bringing in of natural gas, amount to not less than \$25,000,000 annually. This exceeds by approximately \$5,000,000 a year's dividends on all the company's \$290,000,000 of preferred and common stocks outstanding.

The last major reduction in electric rates occurred in 1930, when rates were cut about \$3,000,000. At about the same time, the advent of natural gas service meant a saving of \$8,700,000 to our gas consumers. Since that date no major rate cuts have been warranted, although many minor reductions in certain rate schedules have been made. The most important of these are: special firm gas industrial rate, resulting in a \$40,000 annual saving to such consumers; reduction in electric rate to large building consumers, a \$50,000 annual saving; reduction in rate to electric furnace consumers, a \$30,000 annual saving; reduction in gas rates to the consumers in Livermore and Pleasanton, a \$6,000 annual saving; reduction to steam-heat consumers in San Francisco and Oakland, a \$93,000 annual saving; reduction in gas rates to the consumers in Colusa, Willows, Oroville and Gridley, a \$5,500 annual saving; reduction in industrial gas rates to large volume San Joaquin and Sacramento Valley consumers, a \$28,000 annual saving; and several other smaller rate adjustments.

During the past year, the company has offered to analyze all of its power consumers' physical service conditions and the rate charged for the service rendered. This advisory service has resulted in changes in the service conditions of such consumers and in rate billing for their power service. An annual saving of \$112,000 to several thousand consumers has been accomplished. Obviously, this company has done and is doing its full share in keeping the cost of its services to the public down to the minimum consistent with a reasonable return upon the capital invested in the business by the holders of its securities.

## THE LATE FRANK G. BAUM

An outstanding engineer has been lost to the world of electrical development in the death of Frank G. Baum, who sustained fatal injuries in a fall from the roof of a Redding hotel last March while inspecting newly installed equipment.

Born 62 years ago in Missouri, one of a large family, Mr. Baum came to California in his early youth to carve out his own career. He worked his way through Stanford and after graduating in 1898 became an instructor in the Department of Engineering. His first experience in public utility work was in 1899, when he made tests of the Colgate-Sacramento transmission line, the first high-voltage accomplishment. He did similar work for the Standard Electric Company upon its Electra-Oakland transmission line, and later entered the employ of the California Gas and Electric Corporation.

After the Pacific Gas and Electric Company was organized he became chief engineer of hydro-electric development, and in that capacity visualized the South Yuba-Bear River development, with its main storage reservoir at Lake Spaulding and its string of power houses starting at Drum, on Bear River. Later on he became consulting engineer of the company and took part in the development of the Pit River project, designing the Hat Creek plants and the Pit River string beginning at Pit No. 1, where the waters of Fall River are diverted from the valley of that name and conveyed by tunnel through the hillside into the Pit River gorge. He severed his connection with the company in the spring of 1923 and from that time devoted himself to private practice and experimental work.

Mr. Baum was a man of vision. Many of his visions produced profitable as well as practical results. He was prominent in perfecting 220,000-volt transmission and his later experiments were directed toward higher voltage accomplishment. At the time of his death he had perfected an air-conditioning device using the fan motor principle. The several technical books and treatises which he found time to publish have proved of great value to the electrical industry. He was a member of the American Society of Mechanical Engineers, American Society of Civil Engineers, and American Institute of Electrical Engineers, of which he was made a Fellow in 1914.

## GOVERNMENT IN BUSINESS

(*San Francisco Industrial Review*)

There is not a single reason why government ownership of the electric industry would result in genuinely lower rates or better service.

Government cannot hire more talented engineers or executives than private business—and it is doubtful if the best men would be willing to be spokes in the bureaucratic wheel. The government's buying power would be little different from that of any number of the great utility systems serving the country at the present time. It is true that government can borrow money at low rates of interest and exempts its properties and securities from taxation—but there is no profit to the citizen in that because loss of government revenue from tax exemption of any property must be made up by heavier taxes on other property.

Government plants, when they lose money, make up the deficit from the public treasury, while private plants must pay their own way. It has been the experience that government in business means inefficiency in business—at the public expense. Government undertakings cannot be free from political influence. A government electric system would inevitably result in adding vast numbers of employees to the public payroll—and the taxpayers would have to do the worrying.

Today America has the best and lowest priced electric service in the world. The people have complete control over it, through their public service commissions. The industry is a foremost taxpayer, employer, and purchaser of supplies of all kinds. To give it into the hands of the politicians would not only interrupt this progress, but would be the beginning of an era of higher taxes, broader paternalism, and less individual and industrial freedom.

"Whenever the government sets out to provide cheaper power and follows a policy of providing it no matter what the deficit and the cost to the taxpayers, it has the effect of providing a subsidy to the industry of a limited region served by the project at the expense of the rest of the country," observes *Farm and Ranch*, of Dallas, Texas, in an editorial. "For, it is the people of the entire country who pay the subsidy and it is the industry of the entire country that suffers from such unfair competition."

# PACIFIC GAS AND ELECTRIC COMPANY

A CALIFORNIA CORPORATION

Managed by Californians

Operated by Californians

THE CONSOLIDATED "PACIFIC SERVICE" SYSTEM REPRESENTS (as of December 31, 1931)

13,644 employed in all departments.

\$654,000,000 capital invested in gas, electric, street railway, steam and water plants.

89,000 square miles of territory in which it operates—an area greater than that of England and Wales.

90,000 stockholders.

46 counties of the State in which it transacts business.

1,267,114 consumers served with gas, electricity, water and steam.

2,760,000 people in 46 counties, which is approximately 50 per cent of the State population.

618 cities and towns in which it supplies service directly and through other companies.

\$24,997,000 annual wages paid employees, year ending December 31, 1931.

\$9,608,000 taxes, Federal, State, county and local, year ending December 31, 1931.

1,178,477 horsepower developed in 50 electric water-power plants.

510,187 horsepower developed in 15 electric steam plants.

1,688,164 total horsepower developed in 65 plants.

3,351,343,000 kw. hours sold, year ending December 31, 1931. This is equivalent to the effort of 11,171,000 men.

29,429,747,100 cubic feet of gas sold, year ending December 31, 1931.

34,522 miles of electric transmission and distribution lines. Greater than the distance around the earth.

7,252 miles of mains used in distributing gas. Greater than the distance between San Francisco and Oslo, Norway.

973 miles of canals, ditches and mains used for power and water supply.

1,370 miles of track of railway supplied with electric power.

665,624,794,000 gallons of water storage capacity of 136 lakes and reservoirs. This amount of water would supply the City of San Francisco at the present rate of consumption for approximately 36 years.

215,517 acres of land owned in California.

635 parcels of property owned in cities and towns.

575,624 horsepower in agricultural motors depending on "Pacific Service."

1,194,740 horsepower in mining, electric railways, manufacturing and other motors depending on "Pacific Service."

3,631,369 horsepower connected to system.

PACIFIC GAS AND ELECTRIC COMPANY

General Offices: 245 Market Street

San Francisco

Branches in all principal cities and towns of 46 counties of Northern and Central California.

## **PACIFIC GAS AND ELECTRIC COMPANY**

71st Consecutive  
Quarterly Dividend on  
6% First Preferred Stock

14th Quarterly Dividend on  
5½% First Preferred Stock

Regular quarterly cash dividends for the three months' period ending April 30, 1932, will be paid upon the Six Per Cent Preferred Stock and Five and One-Half Per Cent Preferred Stock of this Company by check on May 16, 1932, to shareholders of record at the close of business on April 30, 1932. The Transfer Books will not be closed.

D. H. FOOTE,  
*Secretary-Treasurer.*

San Francisco,  
California.

## **PACIFIC GAS AND ELECTRIC COMPANY**

### **DIVIDEND NOTICE**

**Common Stock Dividend  
No. 65**

A regular quarterly cash dividend for the three months' period ending March 31, 1932, equal to 2% of its par value (being at the rate of 8% per annum), will be paid upon the Common Capital Stock of this Company by check on April 15, 1932, to shareholders of record at the close of business on March 31, 1932. The Transfer Books will not be closed.

D. H. FOOTE,  
*Secretary-Treasurer.*

San Francisco,  
California.

# Dividend Days

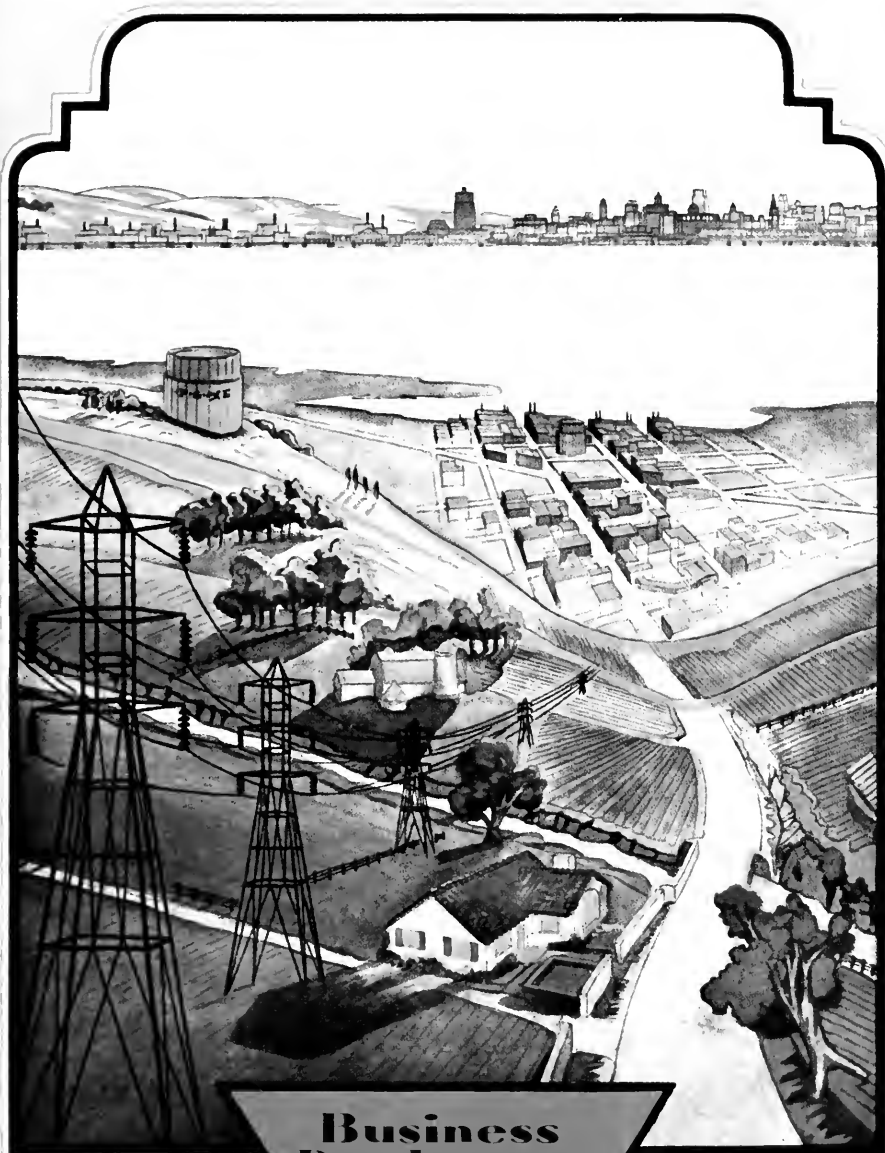
still roll around regularly for the 85,000 investors holding our preferred and common stocks. Quarterly dividends have been paid uninterruptedly upon the Company's first preferred stock since its original issuance, and on the common stock for more than thirteen years.

Present conditions have once more emphasized the stability of this Company's business. Its securities rest upon a solid foundation of property values, and its revenues are derived from furnishing essential services at low cost to upwards of 1,260,000 customers.

## **PACIFIC GAS AND ELECTRIC COMPANY**

STOCK SALES DEPARTMENT • 245 MARKET STREET • SAN FRANCISCO

# PACIFIC SERVICE MAGAZINE



A VISTA OF  
MODERN INDUSTRY

**Business  
Development  
Number**

VOL  
18

JULY 1932

NO  
11

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# Pacific Service Magazine

Volume XVIII

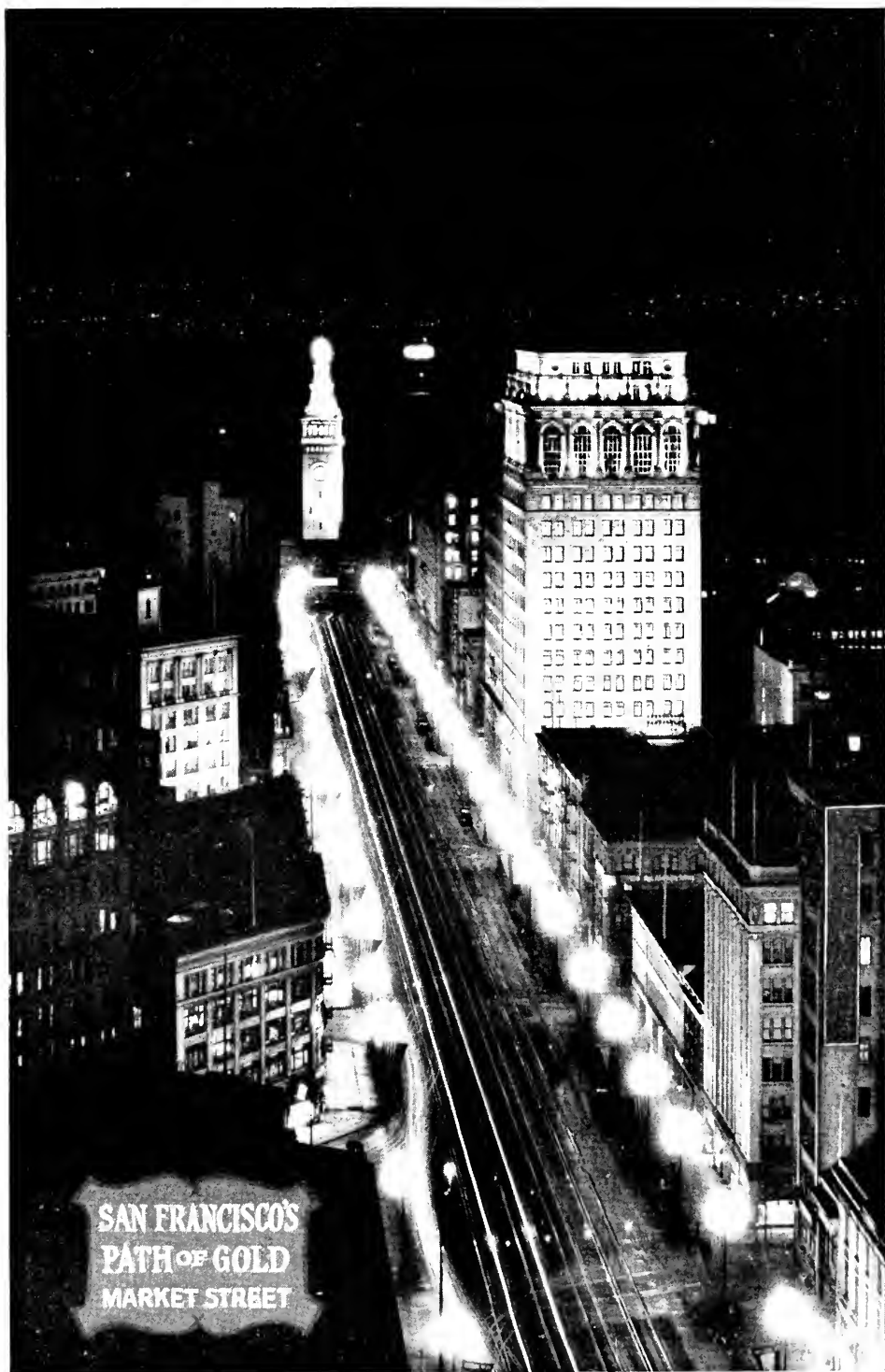
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Issue of July, 1932



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**SAN FRANCISCO'S  
PATH OF GOLD  
MARKET STREET**

Prominent to the right of this picture is seen the Pacific Gas and Electric Company's General Office Building, corner of Beale and Market Streets. Photo by courtesy of Californians, Inc.

## Building "Pacific Service" Through Business Development

A great utility system such as that of "Pacific Service" includes many factors other than mechanical equipment and its operation. Power plants and transmission and distribution lines, gas mains and their lateral lines of service, represent the system in its principal physical aspects. They represent, too, the great bulk of the utility company's invested capital. Every invested dollar must pay a fair return to the investor. If it does not do this, it is not wisely invested, the business in which it is working cannot progress and inevitably that business must fail. Every power plant, every gas main, every item of installation and construction which has been described in these pages throughout the years must obviously pay its own way; it must earn a fair return upon the dollars invested in it. To make certain of such earning requires just as much planning and just as much effort as are necessary in the building and operating of plants. The products of these plants have to be sold and they demand intensive, well-planned salesmanship. For, contrary to general belief, monopoly of our commodities does not mean monopoly of the services which they afford. Power, heat, even light may be had by other means or from other sources, and the problem of selling is also a problem of meeting competition.

This issue of PACIFIC SERVICE MAGAZINE is devoted, therefore, not to the physical machinery of gas and electric production and service but to the human machinery of the Sales Department, the business building organization which finds customers to justify the investment. Herein is description of its organizational set-up, its functions and its accomplishments.

The development of the electrical industry dates from San Francisco's construction of the world's first central station plant in 1879 to the present spread of light and power service into every corner of the world. The gas business is much older, but natural gas, in-

troduced into Northern California less than three years ago, has so completely revolutionized the service and has brought with it so many new problems and conditions that most "Pacific Service" workers think today of the gas industry as beginning with its coming.

Every utility company is invariably confronted with problems, both economic and engineering, peculiar to itself and the territory served. Pacific Gas and Electric Company has been no exception to this rule. Its history and growth show a transition through two distinct periods of development.

The first period was devoted to solving tremendous engineering problems. During the pioneer days, company engineers were called on to perform seemingly impossible engineering feats, in face of widespread skepticism and even open derision. Dams and power plants were constructed in the Sierra Nevada, hundreds of miles from possible markets. Transmission lines were erected to traverse mountains, streams and valleys, carrying higher voltages than were dreamed possible by many of the best engineering minds of the time. These pioneer builders accomplished apparent miracles at a time when there were few engineering principles and no precedents to guide them. That they did well is testified to by dams, power plants and transmission lines, built thirty years ago and still giving efficient service.

Hand in hand with the problems of engineering went the problems of financing. Money had to be obtained to build power plants, and finding it was a difficulty that at times seemed insurmountable. Little was known about electricity. Prophecy that it was destined to become the largest single factor affecting our national industrial and social life was deemed visionary by the public mind in general and by bankers in particular. In the early part of the present century, capital listened to the story and then, being cautious, turned elsewhere to familiar investment

channels where it felt certain there were no hazards. Progress in electrical development was slow. Construction funds were always short and delayed projects were not uncommon until as late as 1914, which witnessed the introduction of customer ownership of utility securities. This definitely established the company on a sound financial basis. Today, "Pacific Service" is owned by 90,000 stockholders in every walk of life, a majority of them residents of Northern California, actually customers on the company's lines.

Having successfully overcome the obstacles of engineering and financing, a far-sighted management looked ahead to the time when problems of sales and distribution would become paramount. For a number of years advancement in the arts and diversity of use of both gas and electricity were so rapid and public acceptance so complete that production problems overshadowed those of sales. Markets were available and eager, but time was required to raise the necessary large sums of money and build production facilities. The products needed little sales promotion; there were orders ahead, with new customers waiting almost as fast as service could be supplied.

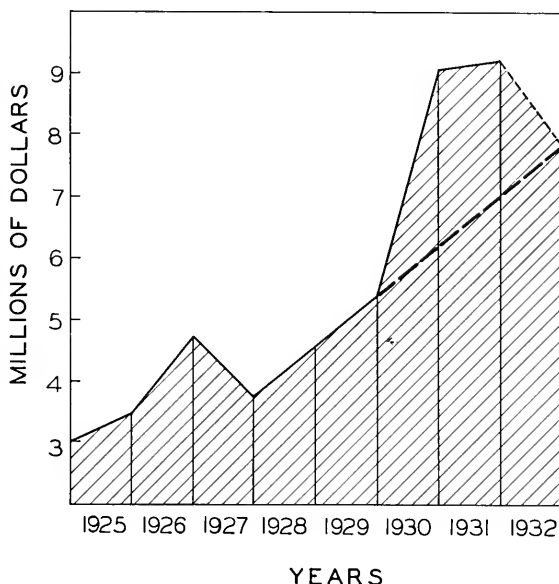
As a consequence, many persons, some of them leaders within the industry, developed the opinion that selling, at least in the aggressive sense of the word, was not necessary. It was argued that the commodities offered had become a household and industrial necessity which consumers would demand without solicitation. The company having a monopoly, a person wanting gas or electric service could get it from no other source. It was necessary therefore to build new plants to meet demand

and to strive for constantly improving service. The new business was bound to come. That this line of reasoning was fallacious was demonstrated by sales activities, promoted either in an experimental way or to offset certain types of competition, such as steam and gasoline engines and coal and oil fuel. Aggressive selling not only met the competi-

tion; it brought in new business that otherwise might not have been obtained for years. It built load, particularly by increasing per capita consumption and, with that, the earning power of existing facilities. During the current period of adversity the companies with well-organized, active sales departments have felt the pinch of the times much less seriously than those that have adhered to the old build-and-wait policy.

In normal times, irrespective of sales activities, growth in consumers and revenue parallels the upward trend of civic and industrial expansion. In abnormal times this growth is retarded in keeping with civic or industrial stagnation. The territory in which our company operates has benefited by rapid growth in both population and industries during the past twenty years. The number of consumers receiving company service in 1911 was 285,593. The total in 1932 was 1,133,593, or an increase of almost three hundred per cent. This rapid increase in consumers was not occasioned solely by economic advancement in the territory served. Acquisition of other operating utilities through consolidation was one factor accounting for it; another was the swift public acceptance of utility service by markets hitherto not served. As a result of this growth, California leads the nation in the

CHART "A"  
GROWTH IN NEW BUSINESS  
COMBINED REVENUES



percentage of homes, industries and farms receiving utility service. Obviously, however, the per capita spread having reached into nearly all the territory of service, the number of new consumers added annually has in recent years shown a decline.

How the annual growth of new consumers in Pacific Service territory has been slowed down is shown by the following comparison covering the period 1911 to 1931:

Increase in consumers in 1912 over 1911, 12.15 per cent; in 1917 over 1916, 6.84 per cent; in 1921 over 1920, 5.20 per cent; in 1926 over 1925, 6.56 per cent; in 1931 over 1930, 1.86 per cent.

While the extension of gas and electric service was proceeding at such a rapid pace, it became apparent that future business, to maintain an appreciable growth in revenues, must be creative business; that is, additional business acquired in markets already receiving some sort of service. This could be accomplished only by aggressive sales and promotional effort. Our company, therefore, laid plans to build a permanent, trained sales organization. On the shoulders of this organization it was proposed to rest the responsibility of developing new business; it had to bear the shock of adverse economic conditions which might possibly arise.

How the sales organization has discharged its responsibilities in both prosperous and adverse times is shown graphically in the accompanying charts. Chart A indicates the trend of new business by revenues from 1926

to 1931, with the estimated quota for 1932. This new business is creative business added to company facilities through promotional activities of the sales organization. The upward swing of new business signed justified the wise policy of preparing during prosperity to meet adversity.

The continuous upward trend of new business

is affected by two factors. The first explains the sharp decrease of new business signed in 1927. This year was marked by a considerable curtailment of campaign work, and as a consequence there was a noticeable falling off in new business. This experience was valuable; it answered for all time all questions concerning the value of an active sales policy. The decrease in new business is also reflected in

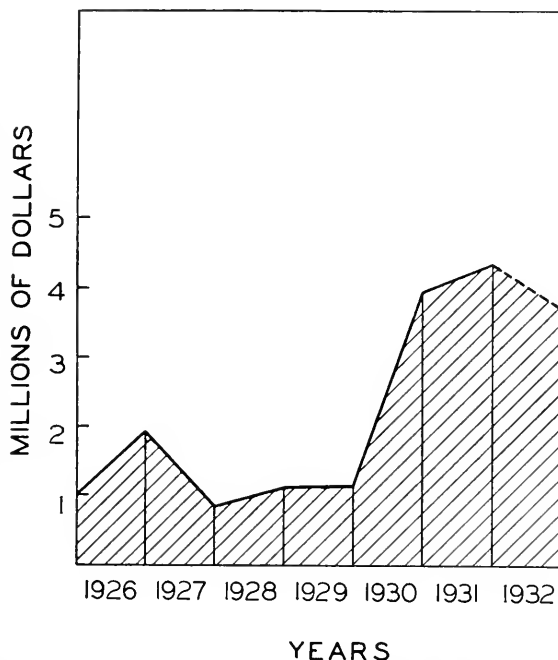
Charts B and C,

which show separately new gas and electric business. The decrease in new gas business follows about the same decline as shown in Chart A, while new electric business is almost stationary.

The second factor affecting the trend of new business, as shown by Chart A, was the completion of the natural gas project and the acquisition of many industrial and other consumers formerly supplied with other fuels; also the consolidation with "Pacific Service" of the Great Western Power Company. Herein is explanation of the large increase in 1930.

If the revenue increase following the introduction of natural gas and consolidation

**CHART "B"**  
**GROWTH IN NEW BUSINESS**  
**GAS REVENUES**



were eliminated from Chart A, the upward trend of new business beginning in 1928 and projected through to 1932, would about meet the quota set for this year, thus emphasizing the ability of organized sales efforts to show a consistent growth year by year.

In planning its activities, the Sales Department at the beginning of each year fixes a new business revenue quota which is to be its goal for the year's accomplishment. Campaigns for the sale of major gas and electric appliances are set up, with an estimate of the amount of new business which each should bring, these estimates being based upon general business conditions and the demonstrated capacity of the sales force. The prevailing depression has of course been seriously felt; and in realization of the difficult task of getting business, quotas have been adjusted downward. Nevertheless, they have been of such proportions during the past two years as to create doubt of their fulfillment. The Sales Department has, however, gone at its task undaunted, recording enviable achievements, making its quota regularly and showing encouraging prospects even in this particularly trying business year of 1932.

At the outset of this year a definite quota of \$7,816,829 of new business revenues was established. Results of the first six months, January to June, inclusive, show 50.5 per cent realized, with probability that fall and winter months will see the quota exceeded.

The sales quota for 1931, when industry was affected more than at any other time since the slump began in 1929, was fixed at \$8,950,000 of new business revenues. This figure was met and exceeded by approximately \$250,000—an impressive accomplishment considering the times—and was made possible only through strenuous efforts on

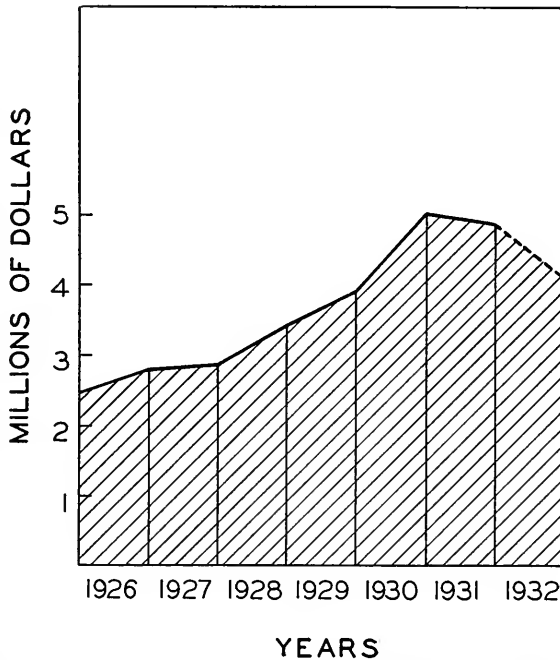
the part of a highly efficient and well-trained sales organization.

Conditions affecting the gas and electric industry at the beginning of 1932 clearly indicated that new business prospects would depend largely on specialized efforts. Business had to be obtained; and the way to get it was to determine where it could be had and then to go after it. To sit back inactive and await the time when normal business already developed

would return in volume was no way to meet the situation. The problem of sales concerned itself with developing new business to replace that which, if not at an actual standstill, was suffering from a partial cessation of commercial and industrial activities.

Extensive surveys brought to light markets of great potential development. These markets existed among residential, commercial and industrial consumers already utilizing some character of "Pacific Service." It was realized, however, that this new business could be acquired only through intensifying sales activities. With these possibilities in mind, the following 1932 sales program of creative endeavor was planned:

**CHART "C"**  
**GROWTH IN NEW BUSINESS**  
**ELECTRIC REVENUES**



## RECAPITULATION OF 1932 SALES PLANS, BUDGETS AND QUOTAS

	Man- power	Budget	Kw. Quota	Revenue Quota
<b>ELECTRIC</b>				
Domestic Electric.....	68	\$ 140,000	61,400	\$ 497,600
Street Lighting.....	4	14,000	1,356	131,000
Commercial and Industrial Lighting.....	20	93,970	6,475	323,750
Commercial and Industrial Power.....	11	58,500	52,930	1,670,000
Ind. Electric Heating.....	2	15,500	7,800	195,000
Agricultural and Rural Power.....	16	59,400	29,121	530,415
Red Seal.....	4	11,500	.....	.....
New Residence Lighting.....	.....	.....	15,310	252,615
<b>Total Electric.....</b>	<b>125</b>	<b>\$ 392,870</b>	<b>174,392</b>	<b>\$3,600,380</b>
<b>GAS</b>				
Domestic Heating and Appliances.....	78	\$ 117,500	.....	\$ 341,500
Domestic Conv. Burners.....	65	66,950	.....	409,000
Commercial Gas Heating.....	41	136,000	.....	721,000
Firm Ind. and Surplus.....	24	96,900	.....	Firm 350,000 Surplus 650,000
<b>Total Gas.....</b>	<b>208</b>	<b>\$ 417,350</b>	<b>.....</b>	<b>\$2,471,500</b>
<b>COMBINATION</b>				
Commercial Cooking and Baking.....	9	\$ 28,750	6,690	\$ 296,330
Dealer Co-operation.....	6	24,000	10,015	Gas 1,011,989 Elec. 436,630
Window Displays.....	2	22,500	.....	.....
<b>Total Combination.....</b>	<b>17</b>	<b>\$ 75,250</b>	<b>16,705</b>	<b>\$1,744,949</b>
Administrative.....	99	343,070	.....	.....
<b>GRAND TOTAL ALL PLANS.....</b>	<b>449</b>	<b>\$1,228,440</b>	<b>191,097</b>	<b>\$7,816,829</b>



## The Domestic Electric Load

The domestic consumer load represents the largest single item of electric revenue. For business development purposes, this load becomes the most attractive field for sales activity in view of reduced industrial operations. A quota of \$497,600 from this source is contemplated by the 1932 sales program. This amount is to be realized largely through the sale of appliances which have not yet received a general public acceptance. They include: lighting fixtures, such as high wattage ceiling units, floor and table lamps, auxiliary heating units, electric ranges and water heaters.

At the present time two divisions of the sales organization are working on this particular activity, one of which is selling electric ranges and water heaters and the other selling lighting and auxiliary heating units.

**LIGHTING.** A statistical report for the five months ending May 31, 1932, shows that 30.1 per cent of all revenues received on the Pacific Gas and Electric Company's system were derived from domestic lighting. The electric industry started with lighting and this feature of electric service still predominates.

It has been estimated that American homes are but fifty per cent properly lighted. Illumination in the home for study, reading, convenience, safety and beauty is a feature of electric lighting service to which the domestic consumer should pay careful attention. Much of this defective vision so prevalent in our modern life, can be traced to poor lighting. The question of health is surely as worthy of earnest consideration as the beauty of fixtures, lamps and globes.

A sales campaign was begun April 1, 1932, to continue through the remaining months of the year, concentrating sales efforts on ceiling units and floor and table lamps. These lamps and units were especially selected for their customer appeal in beauty and workmanship. A reasonable price range was established, varying from \$2.45 to \$20.00. Each unit will return an estimated average annual revenue of \$3.30. A crew of 70 trained salesmen is employed in this one activity. As a result of aggressive work done by this group, 2,545 lighting fixtures were sold during the first six months of 1932.

**MAZDA LAMPS.** It is common knowledge

that a utility company receives its greatest revenues through the collection of a large number of small charges for service. For this reason no item of load building, however small, is overlooked. Surveys conducted by the National Electric Light Association disclose that ten per cent of all lamp sockets in American homes are empty, three of every ten are dormant or non-productive, one out of every three lighting fixtures is obsolete, and shaded, protective light is the exception rather than the rule.

There are 550,000 domestic electric consumers receiving "Pacific Service" with an average of 30 sockets per consumer. This gives 16,500,000 outlets through which the company receives its domestic lighting revenues. Taking the N. E. L. A. estimates, ten per cent of the total leaves 1,650,000 empty sockets from which no revenue is received and which are potential revenue producers.

The sale of lamps is a continuous activity, although sales are intensified during the fall and winter months when schools are opening and days grow shorter. Competitive contests among employees are conducted with cash awards as prizes. These contests are known over the system as "Employee Empty Socket Campaigns."

As a result of employee participation and the office displays the sale of lamps has been rapidly accelerated. Only a few cartons of lamps were sold in 1926, but by 1931 sales had increased to a gross volume of \$97,104. During the first three months of 1932 lamp sales were approximately 33 $\frac{1}{3}$  per cent of the sales of 1931.

**AUXILIARY HEATING.** The sales campaign of auxiliary heating units is really a companion enterprise to lamp merchandising activities. Small heating appliance sales work continues through the year with special programs in the fall and winter months. A crew of ten salesmen is engaged in this one activity in the San Francisco bay area.

Auxiliary heat—that is, heat to supplement the home's main heat supply—is a general need. Few homes have a central heating system reaching into every nook and cranny. Usually there are cold rooms, such as the bathroom, breakfast room, nursery, or perhaps a spare bedroom. To give such rooms the temperature essential to comfort and health is a service for which the portable

electric heater is unsurpassed. It has also the appeal of economy, as the original cost is reasonable and a low heating rate applies to its operation.

**ELECTRIC RANGES AND WATER HEATERS.** The 1932 load-building program included a special campaign for the sale of electric ranges and water heaters. This campaign, known as the P. M. Downing Plan, started April 1st and ended on June 30, 1932. During this three months' period it was proposed to sell 1700 electric ranges and 800 water heaters, or a total of 2500 units. It was estimated that this number of units would add \$125,000 in new revenues.

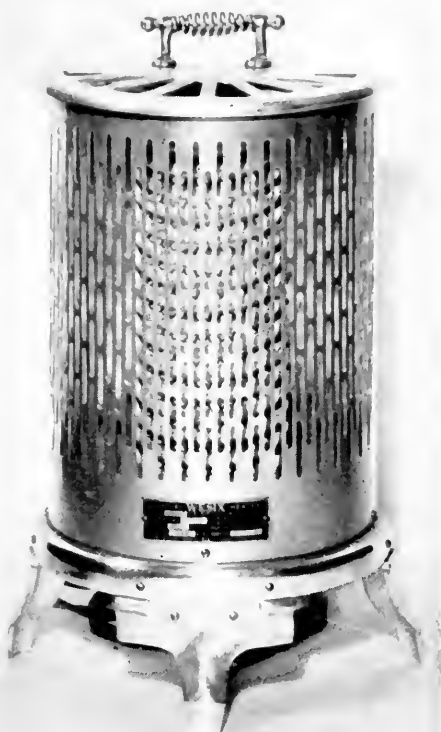
A careful survey of the proposed market showed that there were 479,372 domestic consumers of "Pacific Service" who did not use either an electric range or water heater. It was also estimated that there were at least 125,000 domestic electric consumers who were using other fuels than gas or electricity for cooking purposes. The scope of the market was restricted since the campaign was aimed primarily at competitive fuels, excluding gas.

Sales campaigns for the sale of electric ranges and water heaters are a company activity of many years' standing. For the past six years campaigns have been conducted during the spring of each year for a three months' period. The six-year record is:

Year	Appliance	Quota	Sales	% Quota
1927	Ranges (only)	372	389	105.0
1928	Ranges	560	1142	204.0
	Water Heaters	280	386	138.0
1929	Ranges	1000	1075	107.0
	Water Heaters	350	496	142.0
1930	Ranges	1000	1052	105.2
	Water Heaters	440	656	164.0
1931	Ranges	1660	1881	113.4
	Water Heaters	700	838	119.7
1932	Ranges	1700	1622	95.4
	Water Heaters	800	960	120.0

The quota of 2500 units established for this year was a six per cent increase over the quota of last year. The campaign included both company sales and dealer sales. Aside from its load-building purpose, it had two principal features: first, the replacement of competitive fuels; second, the opportunity afforded dealers to concentrate their sales forces in metropolitan areas where their efforts could be most efficiently employed.

The company placed forty salesmen in the



Type of auxiliary electric heater for use in the home.

field. Since the electric range and water heater activity was one of several years' standing, a long list of prospective customers had been accumulated. In their calls, however, salesmen were by no means limited to this list. Every user of electric service is a prospect for an electric range sale. Nine out of every ten women who do their own cooking dream of one day having an electric range. Especially is this true since the introduction of the modern quick-heating elements, which have given the electric range all the speed in operation to be found in any other type of range. Its beauty of design, its cleanliness, and the absence of smoke or fumes to make renovating of the kitchen an annual necessity appeal always to the housewife, but the greatest appeal of all is in the electric range's complete automatic operation with its clock regulator. A complete meal can be placed in the oven and the woman of the house can then devote her afternoon to other pursuits, knowing that at a stated hour the clock will turn on the heat, and will turn it off when a

thorough job of cooking is done and keep the food piping hot until the moment for serving arrives.

After a house is wired for major equipment such as an electric range, the convenience and economy of an electric hot water heater are impressive. Probably no other piece of electric apparatus used in the home functions as perfectly as an automatic electric water heater and needs less attention. It requires no burners or flues; it gives off no products of combustion, and allows no heat to escape through ventilation. An electric hot water heater, heavily insulated with thermostatic control to govern its functions and keep water at the desired temperature, answers the most exacting requirements for a continuous supply of hot water in the home.

An advertising campaign paralleled the sales campaign with special advertising in 245 newspapers over the entire company system. Small bill stickers were attached to bills of every electric consumer in northern California, calling attention to the range campaign and suggesting pertinent features of convenience and easy terms on which the appliances could be had. These bill stickers were miniatures of bill-board posters. More than 315 billboards in 100 cities were utilized. Also, more than 1300 truck banners were installed on company trucks.

**ELECTRIC REFRIGERATION.** In a surprisingly short period, the electric refrigerator has become one of the most popular domestic electric appliances now being marketed. It is filling a long-needed place in homes, apartments and commercial houses. For the consumer, it provides a cleanly and convenient necessity at low cost. It adds just one more item to the comfort of farm homes, isolated communities and ranches where electric service is available. Summing up the benefits of the electric refrigerator to the industry, it is discovered that:

- (1) It is automatic and free from the owner's habits.
- (2) The energy consumed by one electric refrigerator is the equivalent to that used by a new lighting consumer.



Modern electric range in growing demand for home comfort. Window display.

- (3) It practically trebles the percentage of return on a customer's prorated share of capital investment.
- (4) In a conservatively estimated life of ten years, there is a potential revenue of \$250 per refrigerator.
- (5) A refrigerator operates approximately 4380 hours per year, which is equal to (a) 30 years' use of a vacuum cleaner or washing machine, or (b) the life of four automobiles running the same number of hours at 30 miles per hour.

The 1932 program of building new business by electric refrigeration is built solely on dealer co-operation; the company does not merchandise electric refrigerators.

Company sales activities were grouped under a refrigeration campaign known as the A. F. Hockenbeamer Plan which called for a two months' concerted drive beginning May 1st and ending June 30, 1932. Its purpose, as outlined to 1500 dealers and distributors, was to stimulate public interest in electric refrigerators through system-wide co-operative effort. Dealer participants, under the plan, handled the following well-known makes of electric refrigerators: Frigidaire, General Electric, Norge, Westinghouse, Majestic, Kelvinator, Leonard, Servel and Mayflower.

This year's co-operative dealer campaign calls for a quota of 25,000 refrigerators. It is estimated that this number will return an annual revenue of \$500,000. While these

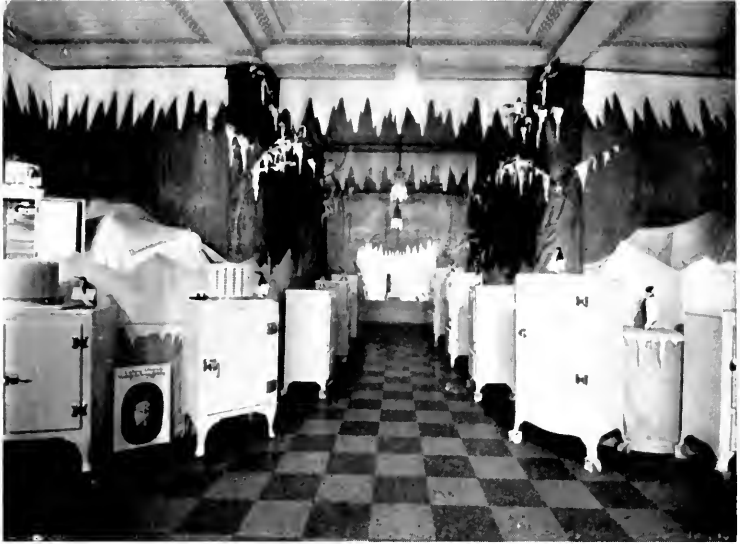
refrigerators are in operation they will have an estimated potential life revenue value of \$6,500,000. The estimated potential life revenue of all electric refrigerators at present connected to the company's lines is approximately \$20,000,000. So far this year a total of 10,135 refrigerators have been sold, returning \$179,010 estimated new business revenues.

An analysis of market conditions at the beginning of 1932 showed that 79 per cent of the homes and apartment houses within "Pacific Service" territory were not using electric refrigerators. The extent of the unsold market was:

Number of wired homes.....	511,742
Domestic refrigerators now installed.....	59,646
Apartment kitchens refrigerated .....	47,658 107,304
Present unsold customers.....	404,438

While the Hockenbeamer Plan was in operation 800 company employees were enlisted in securing prospective sales. Both prizes and a cash bonus were awarded for employees' prospect sales.

The Northern California Electric Refrigeration Bureau, local branch of the N.E.L.A., inaugurated a contest offering 1000 prizes. Meter readers, while on their routes, delivered pamphlets to each of the company's 511,742 electric consumers inviting them to participate in the prize contest by enumerat-



Comprehensive exhibit of electrical refrigeration appliances.

ing the major advantages of an electric refrigerator.

Refrigeration demonstrations were held by dealers, with the support of the Northern California Refrigeration Bureau, at fifty different cooking schools conducted in various cities on the company's system. Advertising, designed to tie-in with these cooking schools, was regularly published. Spring and summer displays of refrigerators were held at special exhibitions in the cities of San Francisco, Oakland, Sacramento and San Jose. Bill stickers were mailed with company bills to 150,000 consumers inviting them to see these displays and familiarize themselves with the latest designs and innovations in refrigerators.

The Hockenbeamer Plan was supported by 225 refrigerator advertisements prepared and published in 41 daily newspapers. These advertisements carried a general selling theme, inviting customers' inspection of displays in dealers' stores and special temporary exhibits arranged in company offices.



# Commercial Lighting, Heating and Cooking

Activities of a wide variety are grouped under the term "Commercial Lighting." Included are the illumination of stores and office buildings, display window lighting, flood lighting and industrial plant lighting. Our company has twenty experienced salesmen charged with developing the 1932 quota of new commercial lighting business. They accomplish their quotas through personal efforts only, as commercial lighting is not supported by advertising or special campaigns.

Good lighting, under modern business practices is a valuable sales adjunct. In fact, it might be said that proper illumination which exhibits the best qualities of merchandise, is the equivalent of a staff of salesmen. As an advertising medium it is the largest single factor in attracting public attention—and the cheapest. The most brilliantly lighted places of either business or amusement are those which attract the largest crowds. The average person dislikes shadows and darkness and instinctively seeks light. Light is protection, safety, salesmanship, and in the home it is health. Business men are beginning to recognize this; civic organizations believe in it as a means of displaying civic attractions to increase population growth and, under existing low rate schedules, adequate lighting for all purposes is within the means of any person or organization.

The importance of commercial lighting as a revenue producer may be measured by the fact that it requires 10 per cent of all kilo-

watt-hours produced to carry this load, and it returns 17 per cent of total electric revenues. New business sales in 1931 accounted for an increase in revenues of \$400,000.

The company does no merchandising with respect to this activity except to supply standard lamps. Since merchandising commissions are eliminated from consideration, salesmen are allowed the utmost freedom in selecting and recommending the fixtures, layouts and glassware best suited to customers' needs.

Selling commercial lighting, as compared with selling electric appliances, demands application of entirely different methods. Commercial lighting selling is a progressive development, passing through different stages from the time the prospective customer is first approached until the lamps are burning. This particularly applies to store, office and window lighting.

The owner of a commercial establishment may submit a proposed lighting scheme in which he estimates a certain required candle-power of lighting. The salesman must analyze the proposed lay-out, point out any deficiencies and recommend improvement in fixtures or design calculated to give greater efficiency. The sale is proposed and made on the basis that added lighting will more than pay for its cost by increasing the customer's volume of business.

**SIGN AND FLOOD LIGHTING.** The prevailing popularity of night sports in northern California has been responsible for a large



An example of window lighting in a Stockton department store.

increase in new flood lighting. Or perhaps it should be said that the great advancement made in flood lighting, permitting out-of-doors areas to be illuminated with the brilliance of sunshine, is responsible for the prevailing popularity of night sports. Including both commercial building and sports areas, there was a total of 2100 kilowatts of flood lighting on the company system as of January 1, 1932. This year three projects have been signed which will add 602 kilowatts to the system total. This class of business has an estimated revenue value of \$50 per kilowatt. Other projects are pending which are expected further to increase the flood lighting total before the year is concluded.

The sale of electrical advertising by means of Neon signs was given serious consideration in this year's sales program. The amount of electricity consumed by Neon signs is small, but this activity is a good example of what promotional sales efforts can accomplish. Heretofore Neon sign lighting has been merged with other commercial lighting, no special effort being devoted to it. During 1930 and 1931 experiments were conducted to ascertain sales possibilities. Results obtained from the experiments were sufficient to justify a special campaign of 44 weeks' duration, starting March 1, 1932, with a

quota of \$28,050 in new business revenues as the sales goal. Regular commercial salesmen were required to utilize a small portion of their time on the activity.

The showing made in new revenues from sign lighting was greater than anticipated. Results of the first 12 weeks of the campaign showed 178 signs sold which are estimated to return annual revenues of \$10,716.25.

The company has no financial interest in Neon sign lighting other than promoting new business revenues through creative sales. All construction and financing are in the hands of sign companies.

**STREET LIGHTING.** Sales promotion under this heading includes highway lighting, lighting of airports and airways, and street traffic control systems. New business revenues for 1932 accomplishments were set at \$131,000. At the present time four salesmen handle this activity in all company divisions.

Street lighting, as a factor of civic attractiveness and a means of reducing crime and traffic accidents, began receiving serious attention among the communities of northern California during 1926. To meet the demands occasioned by community interest in this branch of lighting, a special division of the company's general sales organization was inaugurated. This new division centralized



The national pastime, baseball, now played at night through electric flood-lighting.

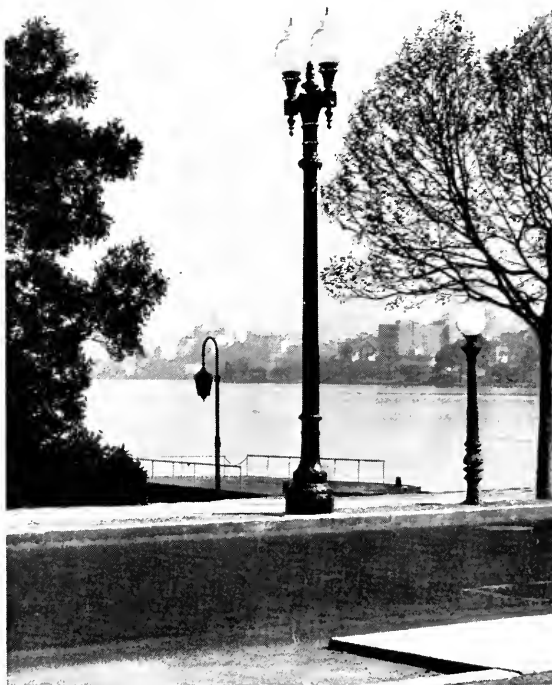
all former sales functions dealing with the subject. A sales engineer heads the street-lighting activities and is charged with developing and distributing sales material, sales data and prices, also compiling statistics, and supervising field work of the salesmen.

Street-lighting service has many admirable characteristics. Its revenues are susceptible of an accurate estimate, and are not seasonal in character. The service creates a good load factor of the long-hour service type.

**COMMERCIAL HEATING AND COOKING.** Sales efforts under this activity are directed to both electricity and gas. They are designed for commercial cooking and baking, and air-heating of public buildings, schools and commercial establishments. This is a newly created division of the sales organization, with nine salesmen operating over the company system who give their exclusive time to this character of sales and nine other salesmen who give part time.

The 1932 sales plan calls for active co-operation by salesmen with hotel and restaurant supply houses, dealers and jobbers in soliciting commercial installations and assisting in displays and exhibitions by manufacturers' representatives. Salesmen are also required to push sales of appliances regularly sold by the company.

New business revenues estimated at \$296,330 were established as this year's quota for sales results, electric revenues being set at \$80,280 and gas revenues at \$146,750. Sales for the first six months of 1932 show a total of \$266,473.50, divided between gas and electricity as follows:



The new and the old. Modern street-lighting unit, in the foreground, contrasted with old style fixtures.

720 electric installations returning new revenues of .....	\$ 99,062.50
496 gas installations returning new revenues of.....	157,511.00
Total new annual revenues....	\$256,473.50

Other prospective installations are pending which, combined with the next six months' sales work, are expected to exceed the year's new revenue quota by a large sum.



## Industrial and Agricultural Power

At a time when industrial plants are seeking every possible means to lower operating costs, the problem of building new business in the industrial power field becomes especially difficult. So, considering the decrease in industrial plant development, the showing made by our company's sales organization so far this year is one which invites favorable comment.

There was approximately 1,150,000 horsepower of manufacturing and miscellaneous power connected to "Pacific Service" lines at the end of 1929. By the beginning of 1932, this total had swelled to 1,950,000 horsepower. Owing, however, to the decreased industrial power usage, which made itself evident toward the close of 1931, the quota of new industrial business development for the current year was conservatively set at 49,174 horsepower, the equivalent of \$1,670,000 in estimated annual revenue. The record for the first six months of 1932 shows \$1,069,453 in new business revenues signed, or 64 per cent of the annual quota.

The services of twenty salesmen are engaged in this activity. In promoting new industrial business, the 1932 sales plan charges the various salesmen with the duty of familiarizing themselves with new and modern types of electric consuming devices and to

bring these new uses to the attention of consumers. A special sales school was conducted in January, 1932. During this year selling efforts are directed largely to the promotion of such activities as air conditioning, mechanical ventilation, conveyor power, refrigeration, and other industrial uses of electric energy.

**ISOLATED PLANTS.** The present low prices of commodities have stimulated manufacturers, as well as oil and other fuel salesmen, to an attempt to increase interest in the sale of electric generating equipment. This year's sales program includes a continuation of past endeavors looking towards the use of central station power in isolated plants. Under the prevailing economic conditions, industrial users of central station power have become more than ever susceptible to comparative cost arguments.

The present sales program looking toward the substitution of central station power in isolated plants began in 1925. At that time there was a total of 59,389 horsepower in isolated plants operating in the "Pacific Service" territory. This total was increased to 108,179 horsepower in 1928 when the Western States Gas and Electric Company was acquired, the majority of the isolated plants being concerned with the lumber industry.



Shell Chemical Co.'s plant in Pittsburg, Contra Costa County.  
Typical of heavy electro-chemical activity.

By adhering to its aggressive policy over the six-year period 1925-1932, the sales organization has been able to close down 53,594 horsepower in isolated plant motors, representing \$830,707 in annual revenues.

A quota of 2,650 horsepower in isolated plants, with an estimated annual revenue of \$47,700, is set for this year's accomplishment. Since the start of a definite sales policy regarding this activity, it has shown a greater revenue per dollar of sales+expense than any other specialized work now being carried on.

**INDUSTRIAL ELECTRIC HEATING.** For a number of years, the sales organization has been promoting the use of industrial electric heating where the consumer's interests are best served. Advancement in the application of industrial electric heating in recent years has caused this activity to become one of major importance. This type of heating, in the territory served by "Pacific Service," has grown from 21,000 horsepower in 1924 to 54,000 at the end of 1931. Sales activity in 1931 added \$191,842 in new business revenues, notwithstanding the fact that industrial depression had affected this branch of electrical use more severely than any other.

By industrial electric heating is meant the application of electric heat to those industrial

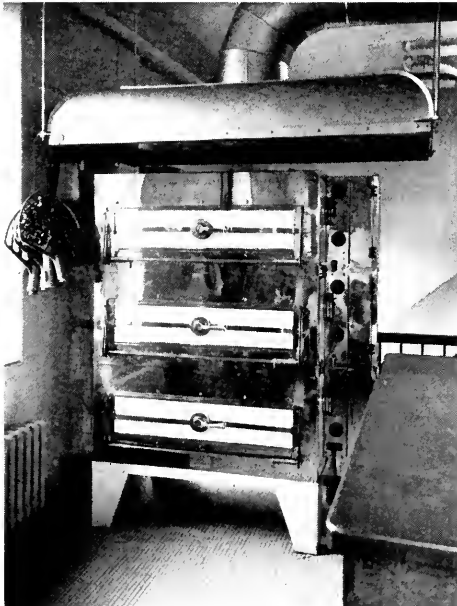


Electric sterilizer for use in dairies.

operations which can be served with this type of heat more efficiently and economically than by heat generated from combustible fuels. In certain industries where accuracy of heat control and application is a first necessity electric heat has proved far more satisfactory than heat from fuels, and fully as economical as other heat. Highest standards of a product can be maintained, and money savings can be made because spoilage is reduced, corrective processes are minimized, labor is reduced, factory space is released for other operations and working conditions are improved.

The more prominent uses to which electric heat is being applied in industry are: heat-treating furnaces, metal-melting furnaces, electric welding, electric ovens, factory space heating, electric-chemical and electro-metal-lurgical processes.

Electric welding is one of the most recent uses which shows promise of revolutionizing the process. As an example of advancement in welding, there is one plant in "Pacific Service" territory which installed a machine to weld sheets of metal electrically. A rotary machine welds 12 lineal feet of seam per



Three-deck electric bake oven at Marine Hospital, San Francisco.

minute and uses electric heat equivalent to 125 horsepower. This installation is a great improvement over hand-welding methods.

**AGRICULTURAL POWER.** Agriculture is the leading industry in California. Rural electrification, inaugurated and encouraged by the power companies of the State, has materially aided agriculture in its rise to this industrial leadership. Today, the California farmer uses more electricity in more labor-saving ways and pays less for it than the farmer in any other state of the Union.

California has always ranked other states in agricultural power usage because of early recognition on the part of electric companies of the importance of the rural power load. It was in northern California that the first successful experiments in rural electrification were made. Transmission lines leading from hydro-plants in the mountains to the urban and industrial sections crossed fertile agricultural regions, and the opportunity to utilize the electric energy was one of which those regions were not slow to avail themselves once it was found practicable to establish connection between transmission systems and farm motors.

Today more than 40,000 farms are served with electricity by "Pacific Service," and the 1932 sales program contemplates the addition of \$530,415 in new agricultural business revenues.

Agricultural sales work is being conducted by nineteen salesmen. These men have all been selected because of past training and adaptability to agricultural pursuits. Each company agricultural division has at least one or more salesmen engaged in the spread of rural electrification. Each salesman is given a district in which he is held responsible for the development of agricultural power usage, the replacement of fuel-burning power equipment and the use of electricity in the farm home.

New labor-saving devices are constantly being developed for agricultural use and it is important that salesmen keep posted on them. One of the most progressive steps taken in recent years to promote extension of rural electric service was the formation of the



Electric furnace installed at American Manganese Co.'s Oakland plant.

California Committee on the Relation of Electricity to Agriculture. This committee is composed of representatives of the California Farm Bureau, faculty members of the University of California Agricultural College and representatives of farmer groups and the electric companies. Its purpose is research work in the application of electricity to farming and it is constantly endeavoring to discover the most economic advantages and the latest uses for electricity in eliminating the drudgery of farm labor. Each year lectures and study courses are given at the Davis Agricultural College which are attended by the rural power salesmen and interested farmers.

Supporting the agricultural power sales program, special advertising was instituted as a semi-monthly feature in *Pacific Rural Press*, a publication reaching approximately 55,000 northern California homes.

In co-operation with the Pacific Coast Electric Bureau, a weekly radio talk is given over Station KQW, known as the farmers' station, on the different phases of electricity and its accomplishments on the farm.





Copyright photo by F. M. Walsh, courtesy of San Francisco Daily Commercial News.

a few of the non-metallic mine products used in cement plants, brick and tile works, potteries, general building work and many other lines of manufacturing and construction. Leading in value and importance in the field of mineral production is the oil industry. Lumbering, too, is another big revenue producer, since 90 per cent of the state's timber land is in the San Francisco Bay region's back country. The sea also contributes its quota to industry through fisheries, sea-food canning plants and boat-building.

Pacific Gas and Electric Company has played a helping part in the rapid building of Northern California's industrial empire. Today farms and orchards are irrigated by electric pumping systems; chores are done by electrical equipment and farm dwellers enjoy the comforts and conveniences of city life. Industrial plants everywhere are electrified. Rates for service have been reduced to a

point where horsepower is much cheaper than manpower. Our company has kept pace with the rapidly expanding economic development and has maintained its facilities far in advance of actual needs to assure adequacy and dependability of service for the future.

Before the advent of natural gas into Northern California, during the summer of 1930, Southern California possessed the strategic industrial advantage of being situated in the heart of the natural gas and oil industries. Many industrial plants, which might have preferred otherwise, located in southern territory because of cheap natural gas as a fuel. Now, however, the interconnected natural gas transmission system constructed and maintained by "Pacific Service" has removed all advantages formerly held in the south. Natural gas rates throughout Northern California are as low as those prevailing in any other part of the state.

## Natural Gas, the Modern Fuel

Natural gas in cheap and abundant quantities became the fuel supply for northern and central California when our company completed its interconnected transmission system, including incidental change-over operations, during the summer of 1930. Years of search by company officials for a dependable natural gas supply ended when a reservoir of this high efficiency fuel was tapped at Kettleman Hills in quantities sufficient for the needs of an empire.

Leading industrial and economic thinkers expressed the opinion that this one last thing needed by industrial northern California—a cheap fuel supply—was the greatest contribution of the generation to its development. It was the final stimulus required to attract new factories and expand existing industries. It meant new payrolls and more workers, and directly affected the living conditions of every man, woman and child in a population of 2,700,000.

Branch lines from the transmission system were extended to more than thirty northern and central California communities formerly without gas service. Many new industries followed the pipe-lines, bringing new investments in plant capital and equipment amounting to millions of dollars. Interconnection of the transmission system reaching into the back country permitted industry to diversify in plant location, building up small communities as well as the metropolitan San Francisco bay region.

The importance of natural gas made itself

felt at once. Lowered rate schedules for domestic use, coupled with a heating efficiency twice that of manufactured gas, cut consumption and bills for service. Living conditions were improved by a heating service automatic in character, free of labor, dirt, smoke, dust and ashes. Added to these advantages was the enjoyment of domestic comfort from basement to attic. Fluctuating market prices and possible shortages of other fuels became worries of the past. The low cost of the new fuel came to the aid of the family budget at an auspicious moment, during a time when the depression had become most acute. Cooking and heating bills were cut to half their former cost, allowing a wider distribution of family income.

It is impossible to estimate accurately the benefits of natural gas in manufacturing and industrial processes. Its use is so diversified as to include 22,000 different commercial and industrial activities. In every operation requiring heat natural gas closely approaches the ideal fuel. It meets the demands of modern, high-speed industry in accurately controlled temperatures, flexibility of control, and cleanliness. Since its control is automatic no capital is required for either storage or labor, or for transportation.

If the more important advantages of natural gas as a fuel in industrial operations are summarized, it will be found that:

- It gives a greater concentration of heat.
- It is convenient and flexible to handle.
- Accurate control can be had.



View of Kettleman Hills compressor station and field headquarters.

There is no combustion residue, such as clinkers, ashes, smoke, and soot.

Fuel storage is eliminated.

Depreciation of plant and equipment is minimized.

A higher type of product is produced.

Much waste in manufactured processes is eliminated.

It is cheap.

It is non-poisonous and entirely without sulphur content.

All of these factors make for a lowered cost of whatever product is being manufactured. The economies offered by natural gas are emphasized by the fact that northern and central California industries quickly turned to the new fuel and found their savings ranging as high as 45 per cent in fuel cost alone.

While the advantages of natural gas alike to industrial and domestic consumers are outstanding, it was fully realized by our company that its introduction would involve problems of sales and distribution. Lowered rates and a higher heat content making for smaller consumption gave opportunity for the sales organization to build load in new fields and increase consumption to compensate for the reduction in gross revenues which naturally occurred.

The new fuel received such immediate acceptance that within a year the loss in gross revenues was compensated by increased volume in sales. Intense concentration on sales activities made this possible. The accompanying diagrams show the effect of sales efforts by a comparison of gas sales of 1931 over 1929. The circle represents the maximum capacity of existing transmission facilities available to "Pacific Service" without the installation of intermediate compression plants.

In 1929 consumption of natural gas was restricted chiefly to company steam electric-generating plants, the complete change-over not occurring until the summer of 1930. Gas sales in 1929, placed on a natural gas basis for comparative purposes, totaled 10,584,074,000 cubic feet. The total at the close of 1931 was 29,663,650,000 cubic feet, an increase of 180 per cent in less than two years. Domestic sales increased 43 per cent, whereas the promotion of new commercial, industrial and surplus use accounted for the balance.

**DOMESTIC GAS HEATING APPLIANCES.** The domestic field, as in the case of electricity, presented a market of large possibili-



Discovery well at Kettleman.

ties in which to build new revenues, especially with house heating. Dealers in appliances, prior to the natural gas era, sold appliances for the home designed, in 90 per cent of the cases, to use other fuels, such as coal, oil or wood. Co-operative sales efforts by the dealers and the company have reversed the order to such extent that within a year's time following the introduction of natural gas 90 per cent of the heating equipment sold was gas equipment.

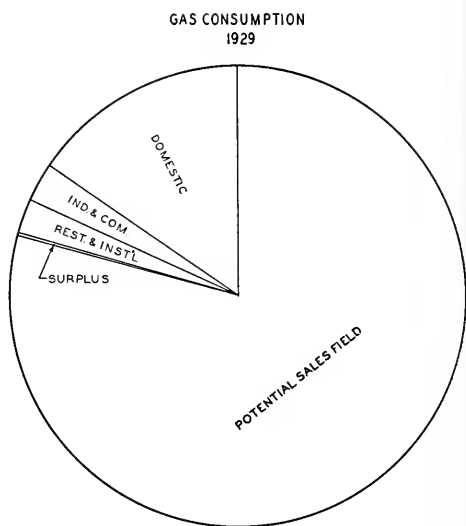
**COOKING RANGES.** In the domestic field, the sale of gas ranges in the more densely populated regions is largely left to dealers. Dealers, in general, specialize in this appliance. However, the company sells gas ranges in new territory and in districts where dealers are not active. The company also promotes gas range sales to replace ranges using other fuels. Development in the manufacture of gas ranges has produced novel features of efficiency and convenience. Many

modern ranges are constructed of porcelain enamel in a variety of colors, giving the appearance of cabinets, and are an attractive form of kitchen equipment. Among the interesting as well as efficient items of advancement are the spacious closets, closed-in tops, self-lighting burners, insulated ovens, utility drawers, and others. The manufacturers have omitted nothing that would appeal to the most fastidious housewife in either a decorative or utility sense.

**WATER HEATING.** The sale of water heaters is confined to replacing other fuels or non-automatic water heaters. In general, the company relies on dealers' sales for replacements and for new homes.

An intensive dealer co-operative plan was inaugurated in February, 1932, to end in May, for the sale of automatic hot water heaters. A quota of 8000 heaters was established, and services of 87 salesmen enlisted to carry on this campaign. The quota was generally regarded as high, but results of the four months' concentration showed that 8150 water heaters were sold, adding \$110,000 in estimated new annual revenues.

Typical of company co-operation in this campaign, representatives of gas appliance dealers were consulted in forming the sales plans. All advertising material produced by the company's advertising department included dealers as well as the company. Newspaper advertising totaled 457 newspaper pages of 160 column inches each; 245 twenty-four inch posters were posted in 54



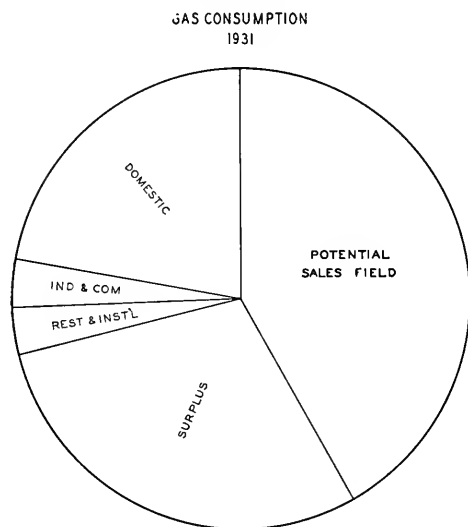
cities and towns in territory served with natural gas; 830 truck banners were prepared and used on company trucks and service cars, and 1,000,000 bill stickers were attached to customers' bills. Several direct-by-mail broadsides were also sent out.

The advantages of automatic water heaters were particularly stressed. Thousands of bills from "Pacific Service" customers were averaged and the discovery made that an automatic appliance heats water more cheaply than any other contrivance. It maintains a dependable supply of hot water at all times, the water being stored in a heavily insulated tank. A thermostat watches the gas and turns the burner on and off as the supply is needed. Easy monthly payments were offered as well as liberal turn-in allowances.

**HEATING APPLIANCES.** This activity is carried on in two divisions: (1) the sale of central heating furnaces and boilers; (2) the sale of small heating appliances such as floor furnaces, circulating types of room heaters and radiant fires.

Gas as a house-heating agent was used in only 10 per cent of northern California homes at the beginning of 1930. So much progress has been made since that time that at present 92 per cent of all heating installations are gas. The leading furnace dealers feature gas for heating in preference to other fuels. Sales by the company of central house-heating equipment are almost entirely confined to replacing competitive fuel installations.

In the sale of small heating appliances the



field is practically unlimited, since this type of appliance finds a ready market with renters and small home owners. Floor furnaces and circulating room heaters predominate in popularity and sales are increasing at a rapid rate. During 1930 company and dealer sales of these two types of heating appliances totaled 4841. In 1931, 18,538 were sold.

Circulating heaters have been designed and constructed to appeal through their artistic appearance as well as through the efficiency of their service. The modern circulator has distinction and beauty suitable for any living room and, in fact, is an attractive piece of furniture. By the turn of a valve every corner of two to four rooms can be reached by quiet, non-odorous and comforting warmth.

A floor furnace, like the circulator, supplies warm air at instant touch sufficient for three rooms in the coldest weather. It requires but a few feet of space beneath the floor.

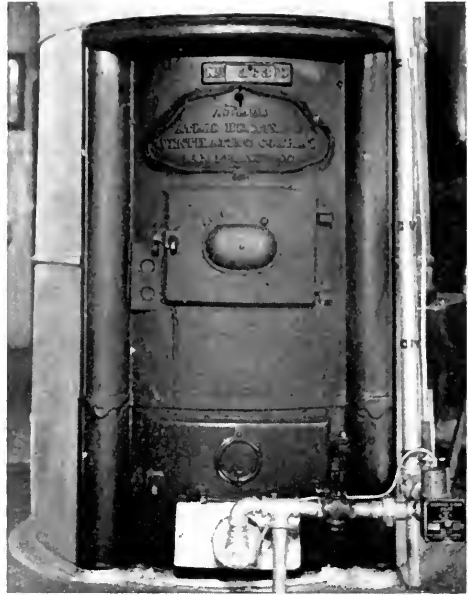
**DOMESTIC CONVERSION BURNERS.** Final results of sales surveys of the domestic house-heating field were not obtained until February, 1930. It was then revealed that in territory having gas service there were 45,000 central house-heating installations utilizing other fuels. A three-year program of sales was initiated having as an objective the conversion of at least 22,000 of these installations to natural gas. Only two and one-half years' time has elapsed and the three-year quota has been met and exceeded.

This activity is one of the most important revenue-producing functions in the distribution of natural gas. It was estimated at the time of the change-over to natural gas that this field would eventually produce new business revenues in excess of \$2,000,000 annually. To date, sales activities have been successful in acquiring \$1,698,264 in new annual revenues by conversion of domestic house-heating units from other fuels to natural gas.

A summary of sales quotas and accomplishments for the three-year program shows:

	Quota	Accomplishment
1930	10,000	12,331
1931	7,000	9,060
1932 (6 months)	5,000	1,900
Total	22 000	23,291

Before actual sales work could start in the conversion burner field many intricate prob-



Coal furnace converted to natural gas.

lems dealing with natural gas utilization had to be solved. A conversion element was designed, tested and standardized and its efficiency demonstrated beyond question before being presented to the public. That this particular marketing problem was satisfactorily solved is evidenced by the fact that only four per cent of all conversion burners sold have been removed for whatever cause.

Conversion burners filled a long-felt want. The fire-box in which natural gas is burned is built of steel. Safety and convenience, aside from economy, present a strong selling argument. All products of combustion go outdoors through the chimney as smoke does from a wood or coal fire. Only healthful warm air is the heating agent and this does not come in contact with the gas. These conversion units can replace any other existing types of central house-heating installations. The space formerly used to store fuel can now be utilized for other purposes. With thermostatic control every room in the house is kept at an accurate temperature.

At the outset of 1932, 65 company salesmen were employed in selling conversion burners. A quota of \$409,000 in new annual revenues has been established which it is anticipated will be exceeded this winter.

# Commercial Building Gas Heating

The cheapness and general over-all superiority of natural gas quite naturally opened new markets for utilization after its arrival in northern California. Among the available fields in which manufactured gas had been unable to compete in price with other fuels was that of heating commercial buildings, hotels, apartment houses, office buildings, hospitals, institutions and other large buildings of a public or commercial character.

Surveys of this market in 1930 indicated 8000 buildings in "Pacific Service" territory, a potential sales field in which natural gas could not only compete in a price range but offers the advantage of higher efficiency. These 8000 prospective customers represented possible annual revenue of about \$4,000,000 in new business.

The building up of a sales crew to develop the commercial heating business was started in 1929. It began work in October, 1930, and its efforts have added more than \$1,000,000 in new revenues from this class of heating. Thirty-five salesmen are handling this activity under the 1932 sales program. The quota for this year is \$721,000 in revenues, which it is expected will be realized by intensive sales activities in the fall and winter months.

Two primary objectives were sought in commercial building heating. These were: (1) The establishment of natural gas heating plants in new buildings; (2) the conversion of other heating installations to natural gas. The first objective has been reached. Virtually all new commercial building construction is now designed to use natural gas heating. The second objective is being achieved, but more slowly. This field requires time and the exercise of constant sales vigilance.

The commercial heating field presented many difficult selling angles to salesmen in overcoming technical and competitive obstacles. The development of burners and control equipment was one of the first problems encountered. This was solved after much laboratory work by company sales engineers in close co-operation with manufacturers. This work resulted in producing new types of burners especially adapted to natural gas and local heating conditions.

Another sales problem was that of competition. The chief competitive fuel for this



Modern San Francisco apartment house heated by natural gas.

type of heating is oil. Oil companies, in competing for the business, developed a tendency of selling oil at extraordinarily low prices. Since natural gas was unknown in this section of California, building owners were inclined to consider price alone as the criterion and eliminated from consideration benefits which only gas, as a fuel, can give. Sales engineers, answering competitive threats, have established seventeen proven points of superiority for natural gas heating over other fuels. These are:

Increased operating efficiency.

Practically no attention required to operate heating system.

Permits boiler attendant to devote more time to building maintenance.

No moving parts . . . maintenance and repairs reduced to a minimum.

Ordering, receiving, and delivery of fuel eliminated.

No fuel storage . . . abundant supply always on hand.

No motors . . . quiet operation.

For new installations, interest on investment less because of lower first cost.

Abundant hot water at right temperature day or night.

Dependability of heating . . . automatic and ever-ready.

Boiler room is clean . . . no ashes, soot, smoke or fuel drippings.

Exterior of building cleaner . . . less painting and washing.

Walls, furnishings, draperies, and linen stay clean longer.

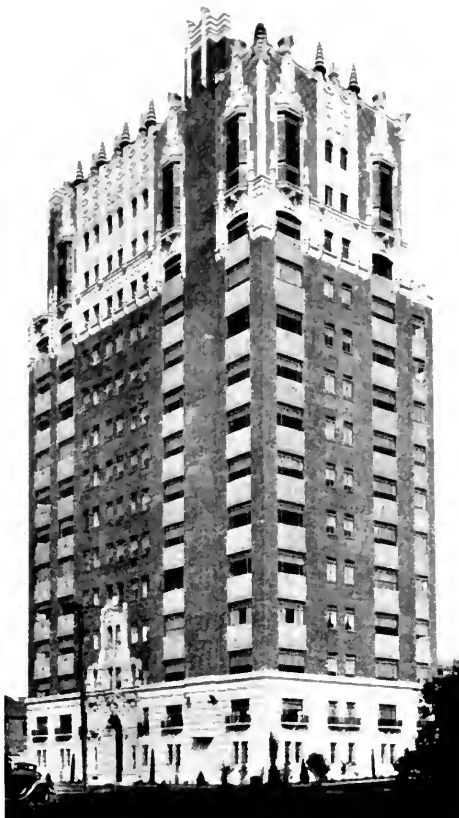
Rental values improved . . . apartments above boiler room just as desirable as others in the building.

Annoying boiler room noise eliminated.

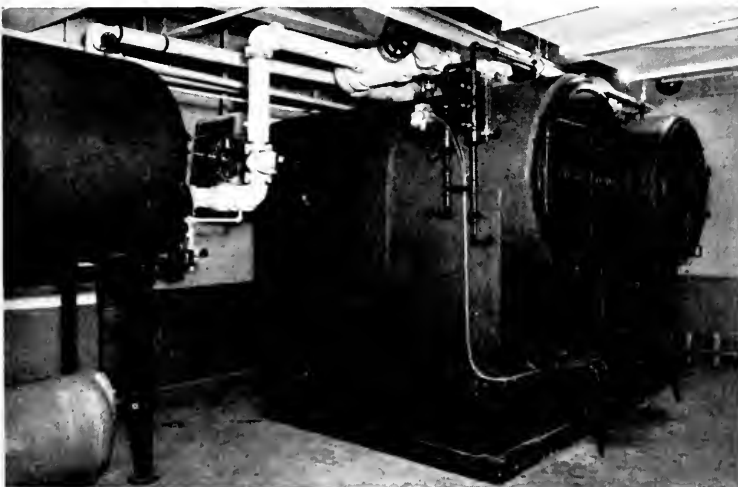
Increased safety . . . natural gas installation eliminates over-heated flues, sparks on the roof, storage of combustible fuels, kindling, and fuel drippings, which, according to the National Board of Fire Underwriters, are the causes of 75 per cent of the nation's "preventable" fire losses.

Greater tenant satisfaction.

To these points of superiority should be added the matter of civic pride. Most apartment houses and office buildings, using other fuels, give forth large quantities of smoke, soot and cinders in down-town business areas. Natural gas has removed this nuisance. Formerly, great industrial regions of this country were advertised by pictures representing many smokestacks belching smoke as



Bellevue-Staten Apartments, Oakland.  
Heated by natural gas.



Boiler room of the John Breuner Building in Oakland.

significant of the speeding wheels of machinery. This is no longer the order of the day in northern California. Millions of tons of cinders, soot and combustion dust have been eliminated from the atmosphere by natural gas improving the appearance as well as the health of thickly settled residential and commercial regions.

## Surplus and Firm Industrial Gas Sales

By referring to the diagram of gas consumption for 1931, it will be observed that the use of surplus gas by northern California industrial firms accounted for more than twice the domestic consumption. More than 80 per cent of all natural gas produced in the United States is absorbed by industrial use. On the system of "Pacific Service" one industrial plant alone may use more gas in its operations than, say, the total domestic use of the city of San Francisco. The primary importance of natural gas, then, under present-day distribution, is relatively industrial.

Natural gas for industrial use is sold under two different rate schedules, "surplus" and "firm industrial" natural gas. By "surplus" is meant the sale of natural gas under contract for heavy industrial or wholesale use at rates calculated to compete with oil and other fuels. Each contract contains an emergency specification which allows the service to be shut off without notice. "Firm industrial" gas is sold at regular rate schedules up to the first 100,000 cubic feet per month, and at lower industrial rates over that amount.

The use of surplus natural gas is generally accepted by industries which fire large steam boilers, kilns, glass-melting tanks, steel and iron melting furnaces, vitreous enameling furnaces, asphalt-melting tanks, incinerators,

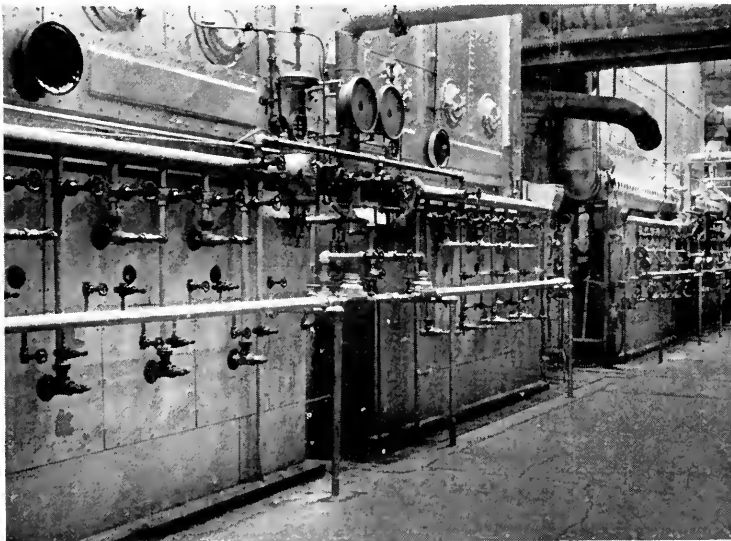
calciners, evaporators and other operations which can readily be continued by other fuels in event of emergency shut-off as provided by the special sale conditions.

Agriculture was quick to turn to natural gas for utilization in dehydrating plants, drying the famous California prunes, apricots, apples, and other fruits and vegetables. Canneries and the sugar and dairy industries also turned to the new fuel.

Since natural gas has been available for industrial use, sales efforts have been responsible for converting more than 50 per cent of fuel oil burning equipment in the territory served. This represents a displacement of three and one-half million barrels of fuel oil. Since oil can be stored in tanks and retained for future use, this is an item of some importance from a conservation standpoint. During the period of three years ending June 30, 1932, company sales achievements have added \$2,868,925 in new annual revenues through the sale of surplus natural gas. The number of establishments changed over has been 664. At the present moment there are 670 contracts as yet unsigned submitted to industrial firms which represent a potential new business field of annual revenues in the amount of \$2,687,649.

A sales force of 24 salesmen handles both

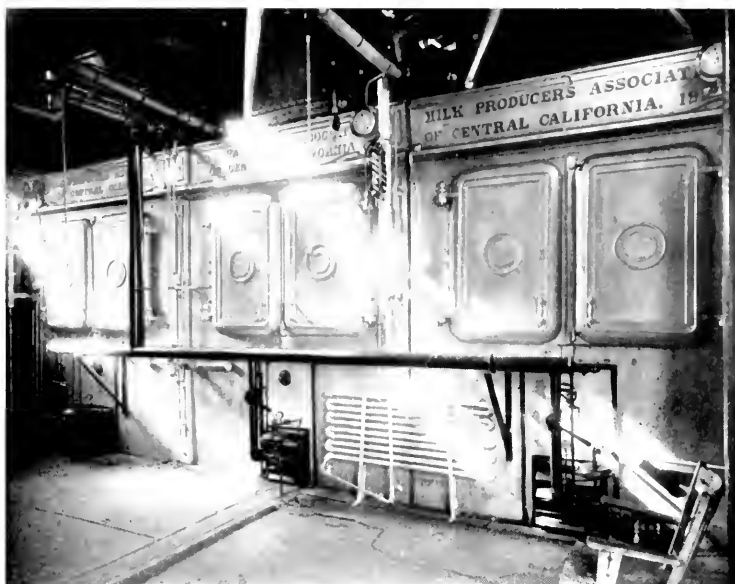
surplus and firm industrial gas sales. These men are nearly all technical graduates. Each man has had considerable experience in factory production problems, particularly heating processes. These men are charged with contacting industrial plants and on their efforts rests the sale of industrial gas. They have surveyed and made records of equipment, fuel usage, industrial heat processes and other



Fibreboard Products, Inc., plant at Stockton. Four 750-h.p. boilers using 3,000,000 cubic feet of natural gas daily.

information concerning every plant or establishment coming under the industrial classification in the territory served with gas. In addition to these statistics, a careful check is made of new industries beginning operation and new processes being instituted in older establishments. Weekly reports are made of new prospective business developed and new business closed.

One of the important industrial conversions in northern California has been that of bakery ovens formerly using oil or wood. More than 200 such ovens have been converted, giving to the baking industry the advantage of cleanliness in fuel which is required in all food-manufacturing plants. Another conversion to natural gas is the Mare Island Navy Yard installation at Vallejo.

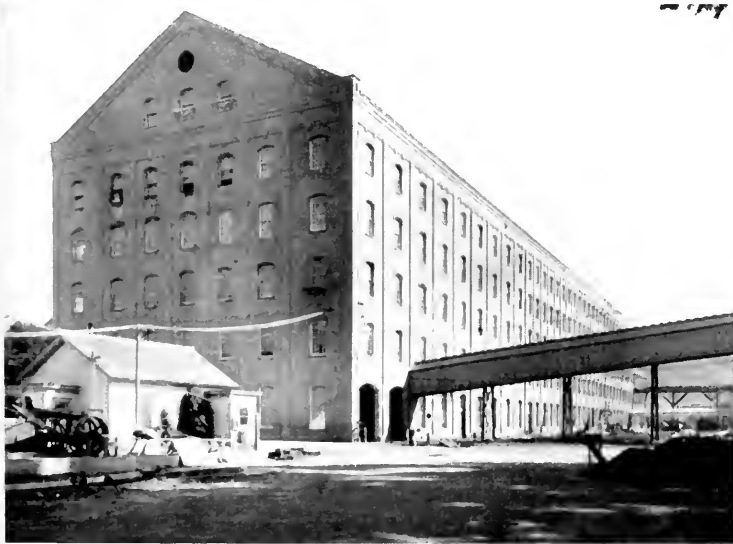


Boiler room, Milk Producers Association, Modesto. Eight 150-h.p. boilers fired by natural gas.

Sales activities in the firm industrial field have accounted for 4,377 installations, with new business annual revenues amounting to approximately \$1,000,000 in the three and one-half years natural gas has been available.

Full support by the company's advertising and publicity department is given to all surplus and firm industrial gas sales work. Ad-

vertisements are regularly placed with trade journals, informative booklets are prepared and distributed and direct-by-mail circulars are sent to prospective users. In addition, the company participates in exhibitions and maintains in San Francisco, at 31 Beale Street, a comprehensive display of all types of industrial gas equipment and appliances.



Spreckels Sugar Factory at Salinas. Uses natural gas exclusively.

## Miscellaneous Sales Activities

In addition to the regular sales organization activities, special efforts have been made to educate and interest "Pacific Service" employees in the company's 1932 load-building program. A road show was organized by the general office sales department which consisted of all elements of a stock theatrical troupe, special scenery and equipment, spectacular lighting effects and a cast of fifteen players.

This road show had a three weeks' itinerary which carried it into every company division. Its presentations were given before 8000 people, consisting of employees, their families, local appliance dealers and others, in all principal cities of northern California. The show traveled from city to city in large trucks bearing banners with the words "P. G. and E. Business Builders."

The purpose of this tour was two-fold. First, to present in dramatized form the company's load-building program, stressing the policy of dealer co-operation in the sale of appliances and illustrating new sales ideas and methods. Second, to enlist the aid of company employees in procuring new prospective customers for appliances and showing them how they could increase their incomes during spare hours by this means.

The stage productions consisted of short talks by the company's chief executives supplemented by talking pictures in which company problems were cited and support urged for a strong commercial program. Invitations were extended to dealers, employees and their families to participate in the year's new business development, and the inter-relationship of manufacturer, jobber contractor-dealer and utility employee was emphasized.

The achievements of the road show were far-reaching and justified the expendi-

ture of time and money in making the tour. An excellent moral effect was had on the communities visited. The stand taken by the company made for a better trade understanding and gave promise for the future at a time when business conditions were still far from encouraging. Employees and their families obtained a better understanding of company problems and their self-interest was brought home in an intelligent and expressive manner. Closer contacts were established between the headquarters sales organization and scattered sales staffs and trade in outlying districts of resultant advantage in harmonized sales efforts.

For some time attempts have been made to stimulate employees to render aid to salesmen through the "pink slip" plan. Booklets were prepared and distributed to all interested employees on which names of prospective appliance customers could be turned in to the salesmen. If the customer was subsequently sold by sales activities, the employee who turned in the customer's name was given a cash payment which varied according to the type of appliance sold. On all major household appliances this payment was \$2.50.

**WINDOW DISPLAYS.** A carefully planned system of window display advertising was instituted in 1931, and is a feature of this year's sales program. These displays are a valuable medium in attracting public atten-



P. G. and E. model farm exhibit at Sacramento State Fair.

tion and stimulating sales of appliances. The display program calls for a regular monthly installation of artistically designed window showings of appliances, either gas or electric, or both, in 77 company division offices.

Before the idea of a syndicated window display system was launched, the sales appeal of appliances was often conveyed solely through the medium of a price tag. Display windows of gas and electric appliances were entirely lacking in the element of dramatization, the quality calculated to arouse a desire of ownership among window shoppers. Under the present system, the price tag has been left off. Appliances are set off by attractive colored backgrounds carrying out a theme designed to picturize selling elements of beauty, convenience, comfort and economy.

CALIFORNIA STATE FAIR AGRICULTURAL EXHIBIT. As an aid to agricultural sales, the company established an agricultural exhibit at the California State Fair in Sacramento during 1931. A total of more than 40,000 interested spectators visited this exhibit during the week of the Fair. The exhibit was so successful in arousing interest on the part of visiting agriculturists that it was decided to continue it as an annual event. The manufacturers, jobbers and dealers in farm electric equipment, who participated in the exhibit, were enthusiastic over its success.

The exhibit consisted of a group of permanent buildings representing a model farm home, barns and out-buildings. In these buildings were displayed all modern devices applicable to the use of electricity in agricultural pursuits. In the home were electric ranges, refrigerators and numbers of small labor-saving devices. Demonstrations were conducted twice daily under the supervision of domestic science experts.

In addition to the demonstrations in the farm bungalow, there were installed a pump-house with a 15-horsepower irrigation pump; a domestic water-supply system; a brooder-house with two electric brooders and an ultra-violet ray lamp; a chicken-house built according to University of California Agricultural College specifications, electrically lighted and controlled by a time switch; a milk-house also built to specifications fur-

nished by the Agricultural College, with a milk receiver on the outside from which milk flowed over aerator coils, brine for which was supplied by a Frigidaire installation, and a cold storage box of the "walk in" type with ample room for four 18-gallon cans, as well as space for farm produce.

A De Laval separator was installed, as were two types of electric sterilizers with two compartment sinks for washing milk cans and milking equipment. Hot water was supplied by a Malsbury 5-kilowatt sterilizer unit. Steam for sterilization was furnished by a 5-kilowatt Wesix steam boiler with a maximum steam pressure of 15 pounds and a capacity of 6 gallons of water, equipped with a pressure gauge, safety valve, water gauge and automatic cut-out.

The cow barn was provided with three stalls, concrete floor, proper drains and the latest De Laval milking machine, all constructed according to specifications of the University of California Agricultural College.

There was also a feed house, an electric hot-bed and a number of other installations all showing the latest electrical farm helps. The building, shrubbery, wiring, piping and all other work of a permanent nature, were provided by the company, the machinery being furnished by various manufacturers who were invited to participate in the exhibit. Cows were provided from various herds showing at the Fair. A number of cows were milked every night at 5 o'clock, and the milk put through the cooling process and stored in the refrigerator. This milking operation attracted considerable attention, many visitors waiting every day for this demonstration.

All of the buildings have been preserved for this year. Permanent improvements have been made in the way of lawns, trees and shrubs. Additional equipment will be gathered within the next month, and this fall the exhibit will be reopened on a bigger and better scale for the Fair of 1932. It is believed that this exhibit and the field work done by the agricultural salesmen have done much to acquaint our agricultural customers with the value of electrically-operated farm equipment and appliances.





dealers' associations in movements for the good of the industry and the protection of the public. These associations include the Gas Appliance Society of California, Retail Furniture Association of California, Retail Hardware and Implement Association of California, Furnace Dealers' Association, Northern California Federation of Plumbing and Heating Industries, Pacific Coast Gas Association, Pacific Coast Electrical Bureau, Electragists, Electrical Dealers' Association and others.

Third, P. G. and E. merchandising advertising is so prepared as to be distinctly beneficial to dealers. It recites the advantage of appliances without mentioning makes or prices and invites prospective purchasers to visit dealer stores. Advance copies of this advertising are sent to all dealers monthly to permit them to tie in with campaigns in which they are interested. In addition to this, newspapers are contacted regularly on behalf of the dealers.

Fourth, newspaper advertising is supplemented by displays on poster boards, cards on trucks and service autos, and stickers on monthly bills.

Fifth, merchandising and advertising campaigns involving any given type of appliance are discussed with manufacturers, jobbers and dealers during the planning period

and all interested firms are thus afforded opportunities to tie in with them.

Sixth, company representatives meet with dealers and their salesmen to advise them as to P. G. and E. rates and policies, as well as to give them pointers on appliance sales.

Seventh, complete records of all dealers and the appliances they handle are maintained in the company's general offices and in its division offices. These dealers are contacted frequently, either individually or in groups.

Eighth, monthly records are kept of all appliance sales made by dealers.

Ninth, the company does not confine its co-operation to the promotion of sales of appliances which it also distributes, but does everything possible to create demand for those handled exclusively by dealers. This was strikingly demonstrated in the assistance rendered in the recent campaign conducted by the Refrigeration Bureau and in the aid given to the Gas Appliance Society in its promotional advertising campaign.

Dealer co-operation has done more than increase P. G. and E. revenues through increasing consumption of gas and electricity. It has served to preserve harmony between the company and its dealer allies.



Scene in the P. G. and E. 1932 company-dealer co-operation road show. Tableau suggested by Dumas "Three Musketeers."

Electric Cooking is so natural it says for itself!

**"My Electric Range has made us Pats"**

One morning, when I was in the kitchen, I noticed that the electric range was so easy to use, and so comfortable, that I decided to try it. I found that it was so easy to use, and so comfortable, that I decided to try it. I found that it was so easy to use, and so comfortable, that I decided to try it.

SEE YOUR DEALER OR THE  
**PACIFIC GAS AND ELECTRIC COMPANY**  
**P. G. & E.**  
Overhead Operation - Managed in California

**Blue Mondays change to GOLD**  
when there's plenty of INSTANT HOT WATER

Automatic HOT WATER TANK

**HOW TO TELL IF YOUR HOME IS PROPERLY LIGHTED**  
...  
FROM THE  
**P. G. & E.**

*Look at these terms*  
ON AUTOMATIC WATER HEATERS

**Only \$4.85 down**

Now you can afford Automatic Hot Water!

SEE YOUR DEALER OR THE  
**PACIFIC GAS AND ELECTRIC COMPANY**  
**P. G. & E.**  
Overhead Operation - Managed in California

**Special Summer Offer**  
**GAS HEATING APPLIANCES**  
new low prices

SEE LOCAL TRUCKS CO. P. G. & E.

**A. F. HOCKENBEAUMER**  
**1932**  
**Electric Refrigeration PLAN**

**PROOF**

That **Natural Gas** has 17 vital operating economies

**P. G. & E. Progress**  
Night Golf Open to San Francisco Players

**DO SOMETHING ABOUT IT NOW!**

**LOWEST OF LOW SUMMER PRICES OFFERED THIS MONTH ON GAS HEATING EQUIPMENT**

SEE YOUR DEALER OR THE  
**PACIFIC GAS AND ELECTRIC COMPANY**  
**P. G. & E.**  
Overhead Operation - Managed in California

**Repeated by popular demand!**  
**2¢ for your old**  
**new Electric Heater**

**PACIFIC GAS AND ELECTRIC COMPANY**  
**P. G. & E.**  
Overhead Operation - Managed in California

**AN ELECTRIC REFRIGERATOR IS NOT A LUXURY ...**

**It saves MONEY on food**

**ELECTRIC REFRIGERATION BUREAU**  
PACIFIC GAS AND ELECTRIC COMPANY  
**P. G. & E.**  
Overhead Operation - Managed in California

**DAIRYMEN**

**For only \$19.95 down**  
**You Can Have A WEEKS STEAM BOILER**

**PACIFIC GAS AND ELECTRIC COMPANY**  
**P. G. & E.**  
Overhead Operation - Managed in California

Advertisements and broadsides assist the P. G. and E. selling campaign.

## Advertising and Publicity

Advertising has aided materially in increasing our company's revenues in spite of general business depression and greatly diminished purchasing. In 1931, to cite the latest figures available, it was an important factor in adding \$9,193,000 to the company's earnings by developing new business. Since the advertising and publicity department's budget for that year totaled \$294,431, the record was \$31 in new revenue for every dollar expended in advertising. The 1932 budget has been set at \$311,172 and equally satisfactory returns are confidently expected.

P. G. and E. advertisements are devoted principally to developing more business for the gas and electric systems through the sale of appliances of all sorts. Obviously, therefore, the advertising and publicity department works in close contact with the Sales Department. It co-operates, too, with the appliance manufacturers, jobbers and dealers to enable them to take advantage of "ties" with the company's advertising campaigns. Furthermore, so that the program shall cover all phases of company activity, institutional advertisements are run from time to time to keep consumers, stockholders and the general public advised as to service facilities and improvements, policies, rate reductions, construction projects and co-operation in community and state development. As an example of aiding general development, advertisements are carried at intervals in nationally circulated magazines to attract new industries and new payrolls to northern and central California.

Advertising mediums used regularly by the company include newspapers, magazines, trade journals, poster boards, direct-by-mail material, signs, stickers on monthly bills, truck banners, motion pictures, house organs, public speeches and radio. Window displays and posters are handled by the Sales Department. The regular schedule calls for an advertisement each week in daily newspapers in the territory and one every fortnight in weekly newspapers. Magazines and trade papers used include a special list appealing to special groups of customers.

During 1931 "Pacific Service" advertising was carried in 265 daily and weekly newspapers of general circulation and in twelve monthly or semi-monthly publications. The

total space for the year aggregated 2400 newspaper pages of 160 column inches each, the advertising being divided between gas and electricity. The advertisements prepared during the year totaled 373, an increase of 242 over the number prepared in 1930. Of the 373 advertisements, 216 were gas, 154 electric and three institutional.

The outdoor advertising space approximated two acres, posters being displayed on 315 panels in 106 communities. These panels, each 24 feet by 12, would, if placed end to end, extend about a mile and a half—from the San Francisco ferry building to the corner of Market and Eighth streets. The posters were changed bi-monthly. The stickers distributed on monthly bills numbered 2,960,000. Nine varieties were used, including a special one advertising the mid-summer gas exposition. Banners, tying in with poster board displays and usually being replicas of them, were carried on 800 company vehicles. Nine broadsides were prepared and mailed to all appliance dealers as well as to all newspapers in the territory. These broadsides reproduced company advertisements to be used during the ensuing month and suggested co-operative advertising by dealers. Nine folders were prepared for distribution to consumers, dealing with conversion burners, electric ranges and electric auxiliary heaters.

News stories released by the publicity department during 1931 totaled 229, not counting numerous special articles prepared for California magazines and trade or technical journals or for Eastern publications. Special articles and reports numbered 159. Clippings referring to P. G. and E. and the gas and electric industries approximated 43,000 inches of space for the year—the equivalent of 268 full newspaper pages.

During the year approximately 155,000 persons were addressed by company speakers, the great majority of them witnessing motion pictures showing gas and electric developments. Meanwhile *P. G. and E. Progress*, circulated among consumers, continued its work of keeping the public informed of company activities and policies and of outstanding or unusual applications of gas and electric service.

## Company's Sales Force Development

The public utility salesman whose business it is to stimulate popular demand for either gas or electric service undertakes a task far more varied and complicated than that which confronts the salesman of ordinary commercial products. He must not only be reasonably familiar with the technical features of his company's business, ranging from engineering to application of rate schedules, but he must be able also to apply his knowledge to the particular needs of each client. In other words, aside from salesmanship, he must possess to a considerable degree the qualities of a business analyst and economist.

A gas salesman does not call upon a prospective customer with the sole purpose of selling him gas by quantity. What he does is to make precise surveys of heat uses and requirements in relation to each case under consideration. Also, with his recommendations he is required to present explanations of technical process, also cost analyses. In the latter connection it is well to remember that satisfied consumers are an indispensable asset to a successful public utility. The salesman designs equipment for particular installations or adapts existing equipment to conversion. His studies in the use of gas as an industrial heating agent are far-reaching. They range from the application of heat through flames of softer intensity, such as are found under boilers, to the higher temperatures required in metal treating.

An electric salesman has similar duties to perform. Each case presents its own problem for solution. Many new uses for electric light and power have been the direct result of extensive studies by salesmen. Electricity as a lighting agent is now in almost universal use where available. Good lighting has been found to be an excellent medium of advertising, as many commercial firms have discovered to their financial advantage. Street lighting by electricity is a civic asset of inestimable value. Flood-lighting has made possible tennis, golf, baseball, football and the general use of playgrounds at night. Electric domestic appliances are relieving the housewife of all drudgery. The electric motor has performed miracles in agricultural development and has rejuvenated the mining industry. In all these features of electric service the salesman has played, and must continue to play, a leading part.

The existing sales organization of "Pacific Service" had its inception with a class of gas students in 1921. A laboratory course of instruction was held for gas salesmen which included studies of construction and operation of gas appliances. This class proved so successful that it was reorganized to include electric salesmen and was definitely established as a general training school. The primary object of this sales course was to provide the framework of a permanent sales organization. It also served to attract technically qualified men who might be developed into salesmen.

Particular stress was laid upon the selection of sales cadets on technical qualifications. Experience showed, however, that the great majority of sales cadets entered the domestic sales field upon graduation; accordingly, the scope of training was further broadened and non-technical men of high caliber were admitted for training in domestic sales. The sales cadets were then classified into two groups, technical sales and domestic sales.

Applicants entering the technical sales group were required to have two years in engineering at an accredited university or college. While this was a minimum requirement, technically trained college graduates were preferred. In the domestic sales group, the preference was also extended to college graduates but with a minimum requirement of two years in an accredited high school or business college.

Sales educational activities included in the 1932 sales program of business development call for fourteen different sales schools. These schools are established for both salesmen and supervisors. The following subjects indicate the scope of studies pursued:

Commercial and Industrial Power; Lighting, Domestic, Commercial and Street; Industrial Electric Heating; Commercial Cooking and Water Heating; Agricultural Power; Red Seal; Electric Domestic Heating, Cooking and Water Heating; Gas Domestic Conversion and Central Heating; Commercial Gas Heating; Firm Industrial and Surplus Gas.

The foregoing is only a partial list of studies submitted for company sales cadets' education. A majority of salesmen employed by our company have from three to ten years' training in their specialized activities.

## The Financial Side of "Pacific Service"

Following is a consolidated statement of Pacific Gas and Electric Company's income account, including all subsidiary and affiliated companies, for the six months ended June 30, 1932, compared with the same period of the preceding year:

### PACIFIC GAS AND ELECTRIC COMPANY AND SUBSIDIARIES CONSOLIDATED INCOME STATEMENT, SIX MONTHS ENDED JUNE 30TH

	6 MONTHS TO JUNE 30TH 1932	1931	+Increase —Decrease
Gross Revenue, including Miscellaneous Income.....	\$43,551,272	\$43,706,917	—\$ 155,645
Maintenance, Operating Expenses, Taxes (including Federal Taxes) and Reserves for Casualties and Uncollectible Accounts.....	18,893,363	18,767,775	+ 125,588
Net Income.....	\$24,657,909	\$24,939,142	—\$ 281,233
Bond Interest and Discount.....	8,018,843	7,564,029	+ 454,814
Balance.....	\$16,639,066	\$17,375,113	—\$ 736,047
Reserve for Depreciation.....	5,766,643	5,418,837	+ 347,806
Surplus.....	\$10,872,423	\$11,956,276	—\$1,083,853
Dividends on Preferred Stock.....	4,048,432	3,974,279	+ 74,153
Balance.....	\$ 6,823,991	\$ 7,981,997	—\$1,158,006
Dividends on Common Stock.....	6,236,117	5,966,995	+ 269,122
Balance.....	\$ 587,874	\$ 2,015,002	—\$1,427,128

The adverse effects of the existing business conditions which influenced the first quarter were even more severely felt in the second quarter. Notwithstanding this, all dividends were earned by a fair margin in both quarters. Our operations were influenced chiefly by:

(1) A continuing decline in all branches of power sales. Efforts to increase domestic and commercial usage have been continued with undiminished vigor and these retail outlets show fair increases over the preceding year.

(2) Increased costs due to increased tax accruals and to larger deliveries to us of power under contracts with other producers who were compelled to curtail deliveries last year owing to drought conditions. Other operating expenses were about \$750,000 less.

(3) Added charges on new capital invested in facilities not now fully employed, due to the business depression. Recovery of only about 2½% in electric gross would suffice to offset these added charges and a moderate approach to normal conditions would enable us readily to absorb the normal capacity of existing facilities and of power supplied from outside sources.

Construction activities are at a minimum and current operating revenues, coupled with the reinvestment of reserves, are sufficient for current needs without any drain on cash resources, which exceeded 16 million dollars at the close of the second quarter.

### PROPOSED ACQUISITION OF PACIFIC PUBLIC SERVICE COMPANY

The company on August 5, 1932, filed with the State Railroad Commission its application for authority to acquire the stock of the Pacific Public Service Company now owned by the Standard Oil Company of California and Pacific Lighting Corporation, and also to exchange its own common stock for the preferred and common shares of the Pacific Public Service Company now outstanding in the hands of the public.

The Standard Oil and Pacific Lighting Companies own 300,000 shares of second preferred stock, 200,000 shares of voting common stock, and 43,396 shares of non-voting common stock of the Pacific Public Service Company, which are to be exchanged, subject to the Commission's approval, for 70,000 shares of the Pacific Gas and Electric Company's common stock, issuable as of October 1, 1932. The stock to be acquired by the latter com-

pany carries with it full control of the Pacific Public Service Company, the 200,000 share of voting common being the only issue having the voting privilege.

There are outstanding in the hands of the public 420,143 shares of first preferred stock and 218,746 $\frac{1}{2}$  shares of non-voting common stock of the Pacific Public Service Company for which the Pacific Gas and Electric Company proposes to offer its own common stock on the following bases:

For each share of first preferred stock of the Pacific Public Service Company  $4\frac{5}{100}$  of a share of common stock, issuable as of October 1, 1932.

For each share of non-voting common stock,  $\frac{1}{15}$  of one share of Pacific Gas and Electric Company's common stock, issuable as of July 1, 1933.

Under this arrangement, the exchange of the total outstanding stock capitalization of the Pacific Public Service Company, including the shares held by the Standard Oil and Pacific Lighting Companies, would require the issuance of approximately 273,648 shares of common stock of the Pacific Gas and Electric Company, having an aggregate par value of \$6,841,200.

As an essential part of the foregoing transaction, the Pacific Gas and Electric Company under a supplementary agreement, acquires from the Standard Oil Company, with certain limitations, the prior right to purchase from the latter either a portion or all of any natural gas which the Standard may now or hereafter produce from lands now owned or controlled or hereafter acquired, by it in fifty counties in California, including Kern and San Luis Obispo Counties and all territory extending north from these counties and the north line of San Bernardino County to the Oregon boundary. By this arrangement large existing and potential natural gas resources of the Standard Oil Company in the Kettleman Hill region and elsewhere are reserved for Pacific Gas and Electric Company.

The gas priorities accorded to this company under its contracts with the Standard Oil Company are of fundamental importance. We have at the present time over one-half million gas consumers who, on the basis of present consumption, are saving at least \$10,000,000 per annum as contrasted with the cost of the manufactured gas supplied before we introduced natural gas in 1929. The developed and potential natural gas resources of the Standard Oil Company are undoubtedly the largest in the State and the preferential position we have obtained with respect to these resources places us in a very desirable position as to gas reserves to meet future requirements. In addition, our acquisition of the Pacific Public Service Company represents, to a considerable degree, a logical extension of our business, upwards of 60% of the Company's revenues being derived from gas and electric service in territory located within or immediately adjoining our own.

Included in the group of companies dominated by the Pacific Public Service Company of which control is to be passed to the Pacific Gas and Electric Company, are Coast Counties Gas and Electric Company, West Side Natural Gas Company, Natural Gas Properties, Inc., with its subsidiary the Natural Gas Corporation of California, California Consumers Company and subsidiaries, California Consolidated Water Company, Coast Natural Gas Company and Coast Industrial Gas Company. The Pacific Public Service Company, through its various subsidiaries, is engaged in the following operations, from which gross revenues approximating \$5,800,000 were derived in 1931:

Electricity is sold in 56 communities in Monterey, Santa Clara, Santa Cruz and San Benito Counties.

Natural gas is supplied in 50 communities in the above-named counties and in Contra Costa County. The Coast Natural Gas Company owns a  $\frac{5}{14}$  interest in the natural gas transmission trunk line extending from Kettleman Hills to Richmond, and owned by the Standard-Pacific Gas Line, Inc., in which the Pacific Gas and Electric Company already has a one-half interest, the remaining  $\frac{3}{14}$  interest being owned by the Standard Oil Company.

Butane (liquefied natural gas) is sold in 10 towns in California, several of which are located in territory already receiving electric service from the Pacific Gas and Electric Company.

The company also does an extensive business in ice, cold storage and bottled water in Southern California.

# PACIFIC GAS AND ELECTRIC COMPANY

A CALIFORNIA CORPORATION

Managed by Californians

Operated by Californians

THE CONSOLIDATED "PACIFIC SERVICE" SYSTEM REPRESENTS (as of June 30, 1932)

11,569 employed in all departments (average for 12 months).

\$660,000,000 capital invested in gas, electric, street railway, steam and water plants.

89,000 square miles of territory in which it operates—an area greater than that of England and Wales.

90,000 stockholders.

46 counties of the State in which it transacts business.

1,249,850 consumers served with gas, electricity, water and steam.

2,760,000 people in 46 counties, which is approximately 50 per cent of the State population.

618 cities and towns in which it supplies service directly and through other companies.

\$21,952,000 annual wages paid employees, year ending June 30, 1932.

\$9,727,600 taxes, Federal, State, county and local, year ending June 30, 1932.

1,178,477 horsepower developed in 50 electric water-power plants.

510,187 horsepower developed in 15 electric steam plants.

1,688,664 total horsepower developed in 65 plants.

3,182,952,745 kw. hours sold, year ending June 30, 1932. This is equivalent to the effort of 10,610,000 men.

33,198,040,500 cubic feet of gas sold, year ending June 30, 1932.

34,522 miles of electric transmission and distribution lines. Greater than the distance around the earth.

7,152 miles of mains used in distributing gas. Greater than the distance between San Francisco and Oslo, Norway.

973 miles of canals, ditches and mains used for power and water supply.

1,370 miles of track of railway supplied with electric power.

665,624,794,000 gallons of water storage capacity of 136 lakes and reservoirs. This amount of water would supply the City of San Francisco at the present rate of consumption for approximately 36 years.

215,543 acres of land owned in California.

643 parcels of property owned in cities and towns.

563,634 horsepower in agricultural motors depending on "Pacific Service."

1,143,506 horsepower in mining, electric railways, manufacturing and other motors depending on "Pacific Service."

3,674,025 horsepower connected to system.

PACIFIC GAS AND ELECTRIC COMPANY

General Offices: 245 Market Street  
San Francisco

Branches in all principal cities and towns of 46 counties of Northern and Central California.



1914  
1,258



1919  
7,057



1924  
21,039



1929  
37,116

FOR EIGHTEEN YEARS, or ever since its original issuance in 1914, the FIRST PREFERRED STOCK of this Company has paid dividends with punctilious regularity to an ever-growing multitude of investors.

RECENT EVENTS, which have forcibly demonstrated the wisdom of careful selection of investments, have but served to emphasize the strong investment position of this high-grade security.



1932  
60,881

**PACIFIC GAS AND ELECTRIC COMPANY**

245 MARKET STREET

« « « «

SAN FRANCISCO, CAL

# PACIFIC SERVICE MAGAZINE



BUCKS DIVERSION DAM AND RESERVOIR  
BUCKS CREEK POWER DEVELOPMENT

Vol  
18

OCTOBER 1932

No.  
10

# PACIFIC GAS AND ELECTRIC COMPANY

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CHAS. L. BARRETT	Assistant Secretary

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W. C. VINCENT, Vice-President and Executive Engineer  
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G. R. MILFORD		Red Bluff
	CHAS. HUGHES	Red Bluff

# Pacific Service Magazine

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Bullard's Bar dam, on the north fork of the Yuba River. Photo taken June 2, 1932, when the dam was spilling 2020 cubic feet per second.

# PACIFIC SERVICE MAGAZINE

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OCTOBER, 1932

Number 10

## *Public Utilities and the Public*

By JOHN P. COGHLAN, *Second Vice-President and Assistant to the President*

Business is passing through a period of test and trial, so fraught with danger that some economists speak of it as a day of "corporate revolution" and predict consequences as far-reaching as those which followed the industrial revolution of a century ago.

Whatever the tendency, it is certain that we are living in changing, even troublous times. We all know the story of the last three years—nationwide prosperity overturned, private fortunes swept away, unemployment thrust upon us, economic and social distress everywhere. In the overturning we have seen our people cast aside common sense, even abandon faith in the country and in its institutions. We have seen an optimistic people become a nation of critics and pessimists, wailing against all methods of business and even predicting the downfall of the "capitalistic system."

Of course neither the dizzy heights of 1929 nor the soul-trying depths of 1932 represent the normal or the balanced in our economic life. The level is somewhere between the two, and just now our people are beating about, striving to regain that level. In the privations of their hour of readjustment, it is not surprising that they remorsefully damn the past and regard the future with suspicion.

In the attempt to fix upon one great cause for existing economic troubles, instead of pondering the many mistakes and errors—national, local, and individual—that are really responsible, a not inconsiderable part of the public is prone to assail business as the sole culprit. These attacks naturally fall upon the corporation, the agency through which in this modern day almost all business is done. If business has failed in the realization of either hope or performance, the critic and the reformer take it that the corporation has failed. They find it easier to blame the machinery of business than the forces, human and economic, which operate that machinery.

The corporation has always had a hard road. A creation of law, having no life in a human world, where life and personality have ever played the greatest part, the corporation has had to make its way on merit and usefulness alone. In its first years it was damned by Lord Coke with the remark that "a corporation has no soul." Early American economists cursed it as injurious to the national wealth and advised moneyless citizens to look upon it with suspicion and jealousy; a caustic bit of advice which, I am sorry to say, has been far too generally followed.

Nevertheless, in spite of prejudice and injustice, the corporation has moved steadily forward, making business efficient and increasing its powers of production until today the United States is the great industrial nation of the world. Yet, if after that long, hard climb, our distinctive and most highly developed agency of business—the corporation—should be taken away from us, we would be cast back 300 years and made a nation of small traders and shopkeepers, operating as individuals or partners in a social state hardly to be envied by the bartering barbarian.

Curiously enough the attacks of today are little different from those of other years. Corporations, the critics tell us, are too large; nay, more, they have reached a fearful size; owners are no longer managers; insufficient publicity shrouds corporation affairs in mystery; neither State nor Nation exercises effective regulation and control over the leviathans of business.

Such are the charges. Let us analyze them and compare them with what we know to be the facts about the typical corporations with which they are connected. First, as to size.

The truth is that size has never been a danger. Its terrors have been more imaginary than real. Size has gone along with the country and the times. When business grew to the country's stature it took big corporations

to handle it. We are a big country and big corporations fit into it. It is impossible to visualize large scale American business in anything but corporate form.

Imagine, if you can, the gas and electric business of today carried on successfully under the old, small-company plan. Experience, as we well know, has proved that not only the large plant but the large system is necessary to economical production and to keep pace with community growth, to say nothing of anticipating it. Without such systems American gas and electric consumers everywhere would be paying many times their present rates.

The plain fact is that modern business must be conducted upon a great scale. Woodrow Wilson said many years ago: "Money and men must be massed in order to do the things that must be done for the support and facility of modern life." We can go a step farther and say that "for the massing of money and men" no means have yet been found to supplant the corporation.

True, the corporation has its faults. It is created and managed by human hands and, like all other human agencies, has experienced mismanagement. Wrongs have been committed in its name, but they have been the wrongs of men and management, not faults of the corporation itself as an agency of business. No fair-minded student of modern American industrial methods can deny that corporate management and morality have kept pace with the honor and morals of the time. High standards among men mean high standards among corporations; a lowering of common morality begets weak and dishonest corporation management.

In the period out of which we are emerging men speculated and plunged and overreached themselves; so did corporations. Corporate morals were no worse than the morals of the individual or of the times; often they were much better, checked as they were by a sense of responsibility and trust resting in management officers.

Faults and mistakes of corporations, often mild and tame compared with the blunders and misdeeds of individuals, take on undue importance because the acts of corporations are rightly taken as the personal affairs of thousands of owners, while those of the individual affect only himself or the few who come within the compass of his activities. In this situation the popular mind thinks mere

size is the thing to be frowned upon and condemned, when what is lacking is moral responsibility in individuals, a thing which can be as secure in a corporation as in a community or in a country.

Corporate ownership today in the United States is spread over 24,000,000 people and the number even in these uncertain times is steadily increasing. Recent reports show that in some of the large corporations of the country small stockholders increased over 40 per cent in the last two years. Great numbers of stockholders obviously mean a diffused and widely spread ownership — an ownership so scattered that owners have little to do with management.

It is upon this situation that unfriendly critics rest their charge that ownership is divorced from management. One distinguished critic tells us that our corporations are in "a state of management control." Another, given to more spectacular language, says our large corporations have become "mere chattels of management officers." Years ago Woodrow Wilson, while Governor of New Jersey, put the same idea more sensationally when he said: "Today there are concentrated in the managers of corporations the resources, the choices, the opportunities, the power of thousands."

All of which sounds menacing when so baldly stated but, stripped of rhetoric, there is nothing menacing in the fact itself. All there is to it is this: American business has become so large and so complicated, requiring so much capital and so much talent, that it cannot be carried on by a few owners managing their own limited funds but must of necessity be administered by great corporate organizations, staffed by men hired because of their special skill and experience. Our commercial destiny has made business management a work for specialists and experts. Not even a lively fancy can picture the American Telephone and Telegraph Company owned and operated by a few owners; or the United States Steel Corporation, or one of the great gas and electric utilities of California.

Would any of these corporations have grown to its present size and efficiency under such ownership and management? Obviously not. It takes millions of capital supplied by thousands of owners to establish these corporations and keep them going. Manifestly these thousands of owners cannot manage

the business of these great corporations. The very idea suggests a town meeting, and business is not a matter of town meetings, not a matter of loose and many-sided management, but of centralized and specialized control; this because prompt decision and constant improvement and extension of facilities are necessary to continuous efficiency of service.

Investors and owners know this and are willing that ownership shall play a secondary part. They give first place to management, and today it is often in management rather than in property that they place their trust. It has become a common thing for investors to say: "We are buying management."

This attitude on the part of investors is itself an approval and an endorsement of management. In return, management has made our corporations great engines of efficiency and production, offering opportunity to millions to share in the profits and rewards of business and carrying on its work with a high sense of trust and responsibility.

Business morality is not a matter of ownership nor of money. It is founded on something deeper than that; it rests on the morals of our people. We like to think that we are a people of honor and square dealing. If we are, our management of business is of the same order, for our managers come from the people, trained in our schools and colleges and tried by our moral standards.

There was a time, of course, when owner-management was the rule, but it outlived its value to the public and was discarded. It went down in competition with a system which developed management by specialists, acting as trustees for thousands of stockholders, and keenly conscious of their responsibility. True, the old regime had its survivors but their example bore no evidence of superior ability to serve the public or even of superior morals. In fact, the largest failure, the saddest public utility wreck of the period through which we are now passing, was that of an owner-managed group of companies controlled and directed by a distinguished family which, as it seems to an observer, placed the power and perhaps the rights of ownership above the responsibilities and duties of management.

When it comes to greater publicity for corporations—more facts for stockholders—our critics are on firmer ground.

The times have shown that business has suffered from too little rather than from too

much publicity. In many cases it has been difficult for stockholders and the public to get the facts of business. Operating and earning statements have been often vague or complicated, insufficient in information or beyond the capacity of the ordinary investor to analyze or understand. As a consequence investors have been curbed and restricted in protecting or extending their investments. There have been times when full information would have caused an investor to retire and perhaps preserve his capital, and others when it would have permitted him to increase his investment very much to his advantage.

The principal critic of inadequate publicity, Professor William Z. Ripley of Harvard, thinks the primary purpose of full publicity is to "serve as a fair warning in case of impending danger. That is only one side of the picture. The eager critic overlooks the fact that publicity also brings before the investor the future possibilities of his company and affords him opportunity to partake of increased earnings.

The Federal Power Commission thinks so much of publicity that it describes it as a method of regulation. "Full publicity," says the Commission, "the publicity that educates the public, is the only route to public confidence." Where voluntary publicity is not forthcoming the Commission demands regulation that will give the public "statistics of cost, adequately standardized, properly itemized, and up to date."

Professor Ripley goes a step farther and advocates as the basic remedy for the present popular discontent with the utilities "complete publicity as to the cost of unit production." "Such publicity," he says, "operates to protect both the public as consumer and the multitude of people whose capital is invested in the business." "More bull's eyes," adds Professor Ripley, "are hit by sure aim with this weapon than by resort to any other implement."

Professor Ripley's dogma may be new to the East, but not to us in the West. More than ten years ago what he is saying now on the Eastern shore was said out here by a public utility leader, a representative of management, if you please, the late Wigginton E. Creed. In 1921 Mr. Creed wrote:

"The public service industry as a whole should adopt the policy of frankness. Many companies have done so; all the others should follow. Suspicion feeds upon concealment.

Most of the distrust of the industry arises from things imagined and not from things known. The facts today are greatly to the credit of the industry, and the facts will do more than anything else to remove doubt, suspicion and question in the public mind. Operations, policies and decisions which are criticized should be explained with complete frankness, and in such a way that the reasons compelling them are perfectly clear and well understood. In short, the public should be taken 'inside the business,' and *when it is*, the public's verdict will generally accord with what management is doing."

Even before this, A. F. Hockenbeamer, now President of the Pacific Gas and Electric Company, then its Vice-President and Treasurer, took up the policy of frankness and facts for stockholders. As far back as 1911 the annual report of the company to its stockholders became under his direction a mine of information. Operating expense, bond interest, surplus earnings, balance sheet items, were set forth then and are still set forth in terms and in words intelligible to every stockholder.

Thirteen years ago, in 1919, John Moody, one of the country's leading financial authorities, said of this company's annual report:

"The investor has the advantage of an annual report which is splendid in form and contents, in that it probably makes a more complete display of earning power, assets and financial conditions than does the annual report of almost any other public utility in this country."

Turning back again to Professor Ripley, we find that he is constantly urging supervision of accounts "as fundamental to a full check upon utility excesses." He writes as if he were advocating a new principle, and he may be in other states, but in California we know the value of supervised accounting through long practice and experience. Here supervised accounting under our Railroad Commission goes back more than twenty years. Not only that, but we have had with it official supervision over the issuance of securities and over the acquisition of property. Our valuations have been checked and our rates regulated. The Pacific Gas and Electric Company tells us in its last annual report that it "has been subject to regulation as to each of these essential phases of operation for the last twenty years." Furthermore, the addition of \$545,000,000 to plant account in

the last 26 years represents property constructed or acquired under Commission authorization. Incidentally, that achievement attracted the attention of George Otis Smith, Chairman of the Federal Power Commission, and he called it a tribute "to the adequacy of public utility regulation."

Recent months have brought forth a new criticism; it is that utilities are anti-social in charging rates beyond the ability of consumers to pay. In this criticism, or should we say attack, the cost of producing service is ignored or forgotten. In its place is set up the theory of ability of the consumer to pay, and to the consumer in economic or financial distress this is an appealing theory.

In certain parts of California, farm groups have seized upon this theory as an argument in favor of lower rates. In Wisconsin the Public Service Commission has gone so far in fixing temporary telephone rates as to declare that rates "cannot exceed what the services are reasonably worth."

Fortunately, from the outlook of consumers as well as stockholders, this order is temporary and probably will not hold in a final hearing. In reason it surely will not hold in the courts, which, of course, will be resorted to if the Commission persists in a plan which, if carried out, would imperil all public service companies within its jurisdiction.

Of course the "reasonable worth" theory is based on an economic fallacy. Suppose, a *Nation's Business* recently pointed out, we try it on the shoe merchant, in which event we should say: "Your rates (that is the charges for your shoes) should not exceed what the shoes are reasonably worth to me. Since my income has been cut in half shoes for which I once paid \$8 are now worth only \$4 to me. Your price therefore should be only \$4."

"A fine argument!" says *Nation's Business*—and so it is—one that shows to what extremes loose thinking will carry normally sensible people, distressed by falling prices and vanishing incomes.

Criticism of this kind must and will fall on its own weight. Low rates are not the end and aim of regulation. Rates of course must not be too high; neither must they be too low. Where rates are too low capital hides and investors withdraw. Facilities and service decline and often fail for want of money to keep them up. Melvin A. Taylor, President of the First National Bank of Chicago

emphasized this fact not long ago when he said that "the inevitable result of regulation which is drastic or confiscatory is to divert investment capital to other channels, thereby making it difficult or impossible for the utility to provide additional plant, equipment and facilities necessary to keep pace with the increasing public demands for service."

At the present time there is a disposition to close in, so to speak, on the utilities. Public opinion tends to the view that there should be further reductions in rates in order to meet the trend of the times. Those who take this position forget that utility rates have been coming down for years. Rates were in the descending scale when commodity prices were on the upgrade. Electricity dropped steadily in price in the boom years and where there was variation in rates for manufactured gas that variation, too, was downward. Economies, mergers, the introduction of natural gas, the invention and adoption of more efficient machinery, all these have worked for lower rates, but the past is forgotten and complaints flow in upon the regulatory commissions. The tendency today is to make Commissions mere hearers of complaints, to so occupy their time with the adjudication of cases as to hide from them the larger questions of regulation.

There are utility owners as well as consumers. Their property must be protected not only because as property it is entitled to protection but because if it is not protected the service it gives will break down and consumers will be handicapped and damaged.

The illustrious Charles Francis Adams said years ago when a member of the Massachusetts Commission that "it is necessary for the consumers' protection and for the public's advantage to keep up quality and quantity of service." The way to do this, he said, is to permit a reasonable profit, to encourage initiative and experimentation and to prevent abuses. "Where freedom is abused," his advice was, "prohibit the abuses, but do not make a few abuses a reason for abolishing freedom."

Yet, as Professor Arthur T. Hadley of Yale wrote in 1927, "A large part of the voters still think that the way to get low rates is to limit the profit of successful enterprise."

At another time that eminent economist said: "It takes a good deal of firmness and a good deal of economic and historical knowledge on the part of a commission or a court to protect the interest of the future against

the loud-voiced demands of the present."

In short, the question of rate regulation must be considered from both sides—from the side of the producer of the service as well as that of the consumer, and neither old prejudices nor whimsies of the moment must have a place in the proceeding.

To hold the interest and support of the producer we must attract his capital; we must allow him a profit commensurate with the risk involved. If this be not done there will inevitably come a day when needed capital will be lacking and stockholders and consumers will suffer, the one because his holdings will decrease in value and the other because the saving pared from a just rate will prove an illusion which cannot make up for the inconvenience of a declining service. Money for hire is never a philanthropist. It must have a fair wage, or off it goes to a more considerate employer.

Enough of disputation and defense. Sometimes I think we dwell too much upon our critics and ponder too often our faults and our shortcomings. Might it not be better for us and for the public if we told more of our service and our achievements, more of our contribution to the common good as employers and taxpayers?

Let's turn a moment to our place as an employer of men:

The gas and electric industries of the country give employment, year in and year out, to nearly a half million men and women. Their payroll exceeds 600 million dollars a year. Nearer home, in the six Western States, which make up the Pacific slope, we find that over 40,000 men and women are furnished employment by our gas and electric utilities. Wages paid to these men and women of the Pacific slope exceed 60 million dollars a year, millions that flow out through all the avenues of trade, for the worker's dollar is not one to be hoarded but to be spent in markets and stores and sent forth to stimulate and give life to industry and commerce. Our business is a permanent business; it strengthens and steadies the commercial life of every community which it enters. Let's go forth and preach that fact.

When it comes to taxpaying, sad to relate, we stand in the front rank. Last year the gas companies of the country alone paid \$76,786,000 in taxes, national, state and local. The electric companies paid \$210,000,000 more. In the paying we turned over to tax collectors 10.5 cents on every dollar we col-

lected in the course of our electric operations; 9.6 cents where we manufactured gas and 7.2 cents where we distributed natural gas.

In these Western States our total tax bill, gas and electric, is about \$27,000,000 a year, which means that out here 10.7 cents out of every dollar of gross revenue goes out to tax collectors. That percentage of gross is higher than the rest of the country, a fact not surprising when in our own state of California, according to students of taxation, \$16 a second, \$960 a minute, go to feed the insatiable mill of state and local government.

If we measure our taxes across the nation by the number of our consumers we find that we pay \$4.23 a year in taxes for every consumer we serve with manufactured gas; \$4.66 for every consumer to whom we supply natural gas and \$8.60 for every consumer to whom we bring electric service.

In a word the gas and electric industries are among the highest taxed industries in the country. Electric comes first with a tax equivalent to 10.5 per cent of its gross earnings and gas second with a tax of 9.6 per cent.

The telephone comes third in the list with government taking 7.7 cents out of its every dollar of revenue. Steam railroads, always in the public mind when it comes to taxes, drop down to sixth place with 6.6 cents of every revenue-dollar taken in taxes. We can go farther than that and make a comparison with all taxable commodities, and when we do we find that few pay higher tribute to government than the gas and electric industries. Gasoline, tobacco, and some drugs surpass us as taxpayers but exclude these and we stand not only at the top of all utilities but we crowd all business for first place.

Our taxpaying should bring us more favorable attention than it does from government. That it does not is perhaps due to our own omissions for we ask little of government and we are as inept as our neighbors in watching and checking public waste and extravagance. We hear the agitator complain about the high cost of gas and electricity and do little to refute him. Would it not be well to command him once in a while to compare the gas and electric bills of the average American family with the tax bill of that family? If he did so and he were to make the comparison, he would find that the average American family pays \$450 a year

in taxes while \$33.78 a year at most covers its electric and \$34.06 its gas bill. So for every dollar that criticism or attack, or regulation, or economy, can cut from the average gas or electric bill, there remains approximately \$11 to be cut from the tax bill of the average family.

Of course the tax bill is not equally divided. People who live in cities and have to buy everything they use pay the highest taxes. It is in cities largely that we operate and it is our consumers there who, like us, are the most heavily taxed. We owe it to them and to ourselves to tell them the tax story.

We must repeat again and again the solemn truth that in protesting against the ever increasing burden of taxes we are fighting the people's fight. It is they who must bear the greater part of the load. Taxes ride on everything the worker buys and, as he has only his toil to sell, his pack is heavy indeed. The storekeeper, too, is harassed at every turn. Not even a tax-eater can dodge the penalty. What is put into one of his pockets is taken out of the other.

Confronted by such a situation it should be plain to us that hereafter it will not be enough for the utilities to protest only against a particular tax on their particular industry. They must oppose all burdensome taxes as a drag on business. Only by a continuous attack on this growing evil can we gain the support of the great mass of citizens who have been beguiled into a false and costly belief. And, as we seek their aid in this fight for the welfare of all the people of our cities, our state and our nation, let us keep in mind that over-taxed communities eye us enviously. They are forgetful of benefits past and present, and in the words of a discerning writer it is "as certain as death that whenever there is a call for new taxes someone will advocate a fresh squeeze of the utilities."

Meanwhile, we shall continue to bend to the task of providing the things that are the life of industry, confident that when the clouds lift and the sun shines again the public utilities will be the radial points of a firmer and greater prosperity, a prosperity symbolized not by the dazzling, reckless, ill-mannered charlatan who left us so abruptly in 1929 but by the goddess of plenty, bringing lasting blessings to all.

# Our Natural Gas Project to Date— Additions to Service Resources

By FREDERICK F. DOYLE, *Manager Natural Gas Division*

Previous issues of PACIFIC SERVICE MAGAZINE have contained articles describing in detail the Pacific Gas and Electric Company's natural gas transmission accomplishment by which natural gas is now transported from the oil fields of Fresno, Kings and Kern counties to the so-called bay district surrounding San Francisco, Oakland and Berkeley, with extensions to Sacramento and Roseville on the east and Healdsburg and Calistoga on the northwest section of the "Pacific Service" territory.

This system, the construction of which was started in December, 1928, has its southern terminal in the Buttonwillow gas field, which is approximately twelve miles north of the town of Buttonwillow and twenty-eight miles west of Bakersfield in Kern County. From that field the pipe-line runs in a northwesterly direction fifty-one miles, where it joins a short line from the North Dome of the Kettleman Hills field in Fresno and Kings counties.

At the junction of these two lines are lo-

cated the company's field headquarters and compressor station. Starting northwest from the Kettleman station the pipe-line runs forty miles through desert land to Panoche Junction and paralleling it for that distance is the Standard Pacific Gas Line, Inc., pipe-line leading from the Kettleman Hills. From the junction the Pacific Gas and Electric Company's line extends to a point near San Jose known as Milpitas Terminal, running through the Santa Clara Valley by way of Hollister and Gilroy. At that terminal the line branches to San Francisco and Oakland.

The Standard Pacific line owned jointly by the Pacific Gas and Electric Company and the Standard Oil Company continues northwest to Tracy, Pittsburgh, Crockett and San Pablo, serving the territory in Contra Costa County in which the Coast Natural Gas Company operates and, also, the area around Stockton, Sacramento and Santa Rosa by re-delivering gas to the Pacific Gas and Electric Company. A line from Tracy to Milpitas connects the "Stan Pac" line



Southwest section of our Kettleman Hills property, showing Compressor Station and other buildings.

with the original or "Bay Line" which, of course, increases the pipeline capacity to the bay district and also practically insures a continuous flow of gas to that area, in the event of the interruption to either line.

When the first instalment of this project was put into operation in August, 1929, that is, the line from the Kettleman Hills field to San Francisco and Oakland, gas was available from only one well, the original discovery well brought in by the Milham Exploration Company on October 6th, 1928. Our company's project, of course, was not built on the strength of that one well, although an enormous producer, but because of the large potential source of natural gas supply which undoubtedly existed beneath the now famous Kettleman Hills. In addition, there existed at the same time a smaller but good gas field at Buttonwillow where eight gas wells had been drilled and the limits of the field not yet defined.

It was on account of the apparent existence of such enormous supplies of this valuable natural resource and the farsightedness of the executive officers of this company that the huge project was undertaken that was to



Kettleman Hills Compressor Plant. Main building.

bring to the people and industries of northern California a new, economical and clean fuel of high heating value which is now being served to 97.3 per cent of the company's customers.

Since the beginning of operations the drilling of new wells in the Kettleman Hills fields has been carried on and satisfactory completions have been made to such an extent that the field has proven to contain the enormous quantities of oil and gas it was thought existed there. It has been estimated by geologists that the volume of gas in the North Dome alone is sufficient to supply the demands of northern California for many years to come. (The Kettleman Hills, geologically, are divided into three areas known as the North, Middle and South Domes.)

At the end of 1929 there were four producing wells in the North Dome, at the end of 1930 six wells, and at the end of 1931, thirty-two producers. During this year eleven additional wells have been completed, bringing the total up to forty-three wells capable of producing oil and gas. At the present time fourteen new wells are being drilled and on two locations drilling operations are temporarily suspended. In the North Dome, where the present estimates of the geologists are that 10,800



Kettleman Hills office and Chemical Laboratory.

acres are practically sure of being productive, there will be 540 producing wells if and when the field is completely drilled, based on the drilling of one well only to each twenty acres.

It will be seen from the above that although considerable drilling has been done during the past three years only seven and nine-tenths per cent of the total number of possible wells has been drilled. When this company started to take gas from the Kettleman field there was about eighty million cubic feet of gas available daily. This production was increased until the amount exceeded five hundred million cubic feet per day, a great amount of which was being wasted on account of the production being in excess of the market requirements.

Due to the co-operation of the oil companies operating under the California gas conservation law the waste has been reduced to a minimum and is now less than ten per cent of the total production. At the present



Gas Dispatcher at Kettleman headquarters.

time eleven of the producing wells are shut in as a result of the effort to conserve gas and curtail oil production.

Such conservation measures are certainly advantageous to this company as well as the people of the State as great quantities of natural gas which would be wasted to the atmosphere are being conserved, thus insuring the supply lasting a greater number of years. The oil companies also benefit greatly due to the fact that revenue will be obtained from the sale of the conserved gas which otherwise they would not receive.

On December 13th, 1931, the first well in the Middle Dome of the Kettleman Hills started producing. It was brought in by the Petroleum Securities Company and is known as Burbank No. 1. The initial production was twenty-six hundred barrels of oil and thirty-four million cubic feet of gas daily. Although this well is off production at the present time, due to mechanical troubles, it proved that there is oil and gas underlying that dome. The possible productive area is not known as yet, but it will not be as great as the area of the North Dome and perhaps only half its size.

One of the wells completed this year in the Middle Dome was the Standard Oil Company's well, starting at the rate of 856 barrels of oil daily and 26,057,000 cubic feet of natural gas. The company has encountered trouble with this well but hopes to have it back on production in the near future. In



Oil-gas well at Kettleman Hills.

anticipation of production in that area the Standard Oil Company has completed the construction of a gasoline absorption plant to treat the gas that will be produced and our company has laid a new sixteen-inch pipe line with the necessary measuring facilities to secure gas from that location, thus giving us a new source of supply.

It is expected that the Middle Dome will be drilled along the same lines as the North Dome, that is, one well to twenty acres, when the field is completely drilled and that the same efforts will be made in that area to conserve the natural gas which will be aided by the existence of our pipe line.

During the past three years additional wells have been drilled in the Buttonwillow field, so that at the present time there are sixteen wells from which gas can be obtained if needed. Our lines are connected to eight wells and at the present time connections are being made to the other eight producers. Seven new wells are being drilled in that district which will bring the total up to twenty-three as it is almost a certainty that the new ones will produce gas.

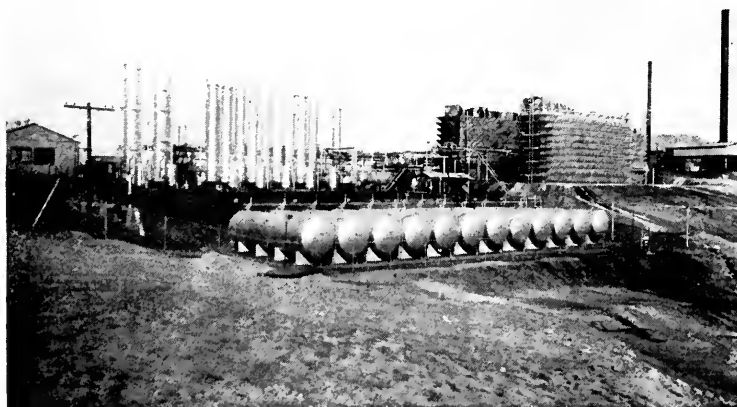
The present estimated potential production of that field is 134,000,000 cubic feet of gas daily, all of which is shut in as part of the movement to conserve gas. Production from that field would tend to increase waste in the Kettleman Hills field.

Three small gas wells were completed during the past year in a new area known as the Dudley Ridge Field, which is located a few miles to the east of the Kettleman Hills Mid-



Four oil and gas wells at Kettleman.

dle Dome. These wells are light producers, the total potential production being probably five million cubic feet of gas per day. The probable extent of the field is not known, but it is believed that the productive area will not be as extensive as at Buttonwillow. However, our company has a line laid to that area in order to be able to take what gas is available if it is needed.



Los Nietos Producing and Refining Co.'s gasoline absorption plant at Kettleman Hills.

From the above it will readily be seen that the company is in a much stronger position in regard to the supply of gas available than it was upon the starting of its natural gas operations, and as drilling continues to be carried on upon the lands covered by the company's contracts for the purchase of gas, the available supply will be increased.



Northwest section of Kettleman Hills property, showing dwelling houses for married employees.

It is possible also that the drilling of "wild-cat wells" will open up new gas resources in the future.

To those readers who are not familiar with the characteristics of wells an explanation of how the gas is obtained might not be amiss. In the fields there are produced two kinds of natural gas, known as "wet" gas and "dry" gas. The wet gas is obtained from wells which produce both oil and gas, whereas the dry gas is obtained from those wells which produce gas only. The wells in the North and Middle Domes of the Kettleman Hills produce wet gas and those in the Button-willow and Dudley Ridge areas produce dry gas only. The wet gas is so called because as it comes from the well with the oil it carries with it gasoline vapors which are, and must be, removed before it is sold to us for transportation and delivery to the consumer. The presence of gasoline in the gas delivered by our company would cause no end of trouble in giving high-class service to the customer, while, on the other hand, the removal of the gasoline affords another source of revenue to the oil companies.

As the oil and wet gas come from the wells under enormous pressure they are led through pipes to high-pressure traps where the oil and gas are separated. The oil is delivered into tanks placed near the traps and the wet gas flows from the traps through pipe lines to gasoline absorption plants. There are many odd names for pieces of apparatus or arrangement of piping and fittings in the oil

fields. The several valves and fittings on the top of a well are known as a "Christmas tree" and the fittings through which the flow of oil and gas is controlled are known as a "flow bean." Accompanying photographs show a "Christmas tree" on one of the wells in the Kettleman Hills and a general view of several wells over which are steel derricks used for drilling and maintaining the wells.

In the absorption plant the wet gas enters the bottom of a tall cylindrical tower or scrubber. There are a few feet of absorber oil in the bottom of the tower through which the gas passes, and as it rises through the tower it comes in contact with fresh absorber oil which is passing down through the tower. The absorber oil, which is very much like kerosene, absorbs the gasoline from the gas which then passes out the top of the tower dry and is ready for delivery into our pipe lines. Before entering our lines the gas is measured through orifice meters which must be very accurate at all times due to the large volumes of gas delivered.

During the summer months when the demand for gas is light the natural pressure forces the gas to the top of the well, through the traps and absorber plants into our lines and on to the appliance of the consumer two hundred miles or more away. In the winter months it is necessary for us to re-compress the gas at our compressor station in order to utilize the full capacity of the pipe-line system.

During the life of an oil field the natural

well pressure gradually falls so that eventually all of the gas transported to the cities has to be pumped all the year around.

The natural gas as obtained from the "dry" gas wells flows from the wells through scrubbers to take out any particles of sand or small amounts of water vapor that might be in it, thence through meters and into the transmission lines.

The original or discovery well brought in in the Kettleman Hills was completed at a depth of 7108 feet. It produced 3,800 barrels of oil a day and 80,000,000 cubic feet of gas. This is at the rate of approximately 21,000 cubic feet of gas per barrel of oil, which is known as the gas-oil ratio. The oil was very light, being almost as light as gasoline; in fact, it could be used directly in an automobile engine.

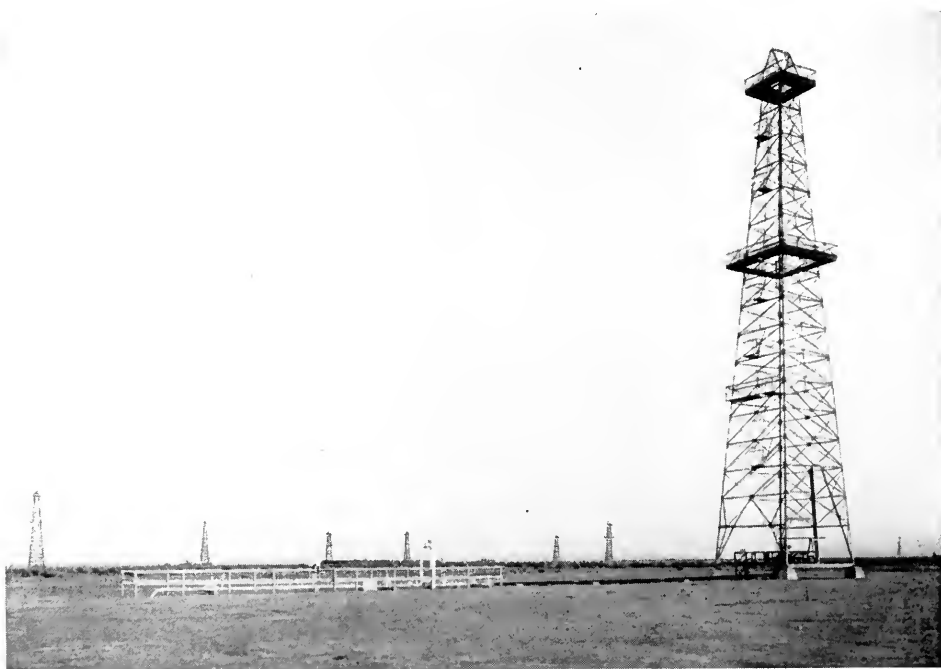
Other wells drilled shortly after the discovery well was brought in were put down to approximately the same level and produced gas in greater amounts having gas-oil ratios as high as 40,000 cubic feet to one barrel of oil. Later it was found that by drilling to depths around 8400 feet a heavier oil was obtained and the gas-oil ratio reduced to approximately 1000 to 1.

By drilling low "gas-oil ratio" wells the gas production of the Kettleman Hills was reduced, which was a step toward conservation. Thirty-five of the forty-three producing wells are at depths ranging from 8000 feet to 8997 feet, the latter depth being the greatest of all the producing wells in the field. Three wells have been drilled to depths slightly below 9300 feet but have not been brought in as producers as yet.

The dry gas wells at Buttonwillow are at levels around 2700 feet, and the Dudley Ridge wells approximately 1100 feet in depth.

Considerable changes have been wrought in the oil-field territory since our company invaded it. Kettleman Hills headquarters station is quite attractive. Not only are the offices and other buildings commodious and up-to-date, but much has been done to make the resident employee contented with his lot. Trees, shrubs, flowers and lawns flourish where once was an inhospitable sagebrush desert and the living quarters are cozy and comfortable.

The station houses forty-three employees, including head field operator, foreman of the compressor station and foreman of pipe-line maintenance and repair crews.



Section of Buttonwillow Gas Field.

# The Substation Feature of the Electric Distribution Problem

By M. C. McKAY, Assistant Engineer of General Construction

Through the pages of PACIFIC SERVICE MAGAZINE our readers have been kept informed of the extensive developments of the Pacific Gas and Electric Company, in the hydroelectric plants of the High Sierra, in steam electric-generating stations near the metropolitan centers, and in the transmission lines and interconnections between. Considerable space, too, has been devoted to descriptions of our company's high-tension distributing substations to which the power received from the far-away mountain power plants is transmitted at pressures ranging from 220,000 to 60,000 volts and there "stepped" down to more moderate voltages for re-transmission to the various centers of distribution.

Closer in interest, perhaps, from the standpoint of the consumer are the local distribution substations whose principal function it is to transform the high voltages of the transmission system to lower voltages suitable for domestic and commercial applications in our homes and industries.

The typical electric substation is situated

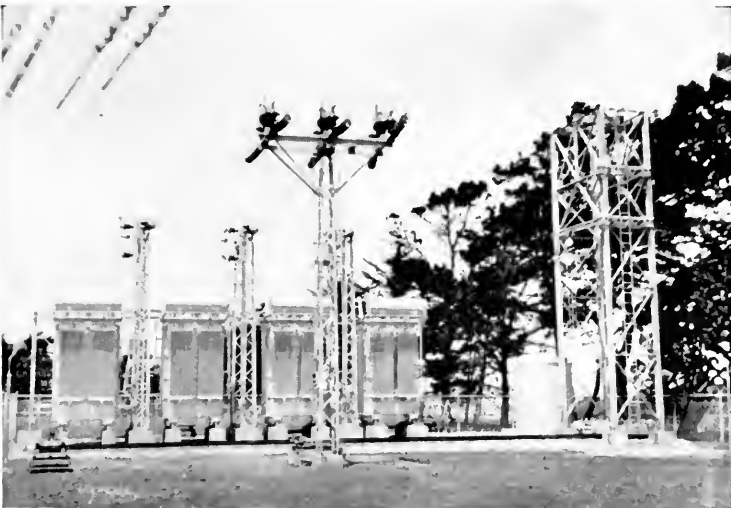
in the midst of the area which it serves. To it are led the transmission lines from the high-tension stations. Within the substation the electric current is passed through transformers which reduce the voltage to values suitable for distribution. In some substations the alternating current is converted into direct current for uses to which alternating current cannot be adapted. From the substation leads a network of lines or cables conducting the current to the points of utilization.

In addition to transforming or converting the power, it must also be segregated and, in many instances, regulated. This requires a multiplicity of switching and other devices to insure continuity of service and uniform voltage to the consumer. In order to maintain the highest standards of service and serve the increasing load, it is necessary to build new substations and reconstruct the existing ones at rather frequent periods.

Engineering and economic studies are constantly under way to predicate the load growth and future demands upon these substations.

A close scrutiny is also made of inventions and the applications of new equipment and devices. As far as practicable the probable location of new industries and power-consuming developments on the Pacific Service system must be anticipated in order that the requirements may be met as they develop.

Every substation presents individual problems

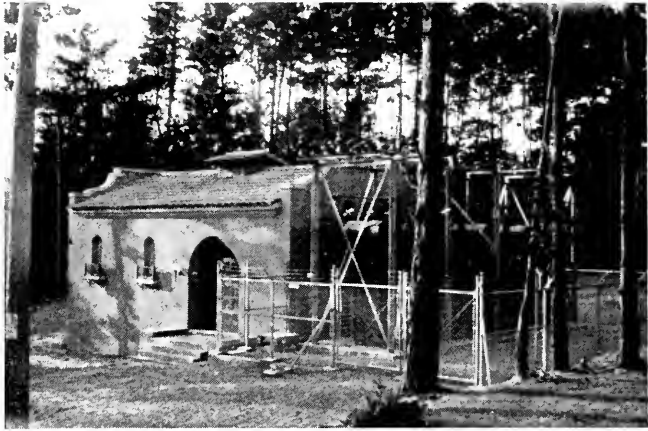


The substation at Del Monte, near the famous resort.

regarding its location, the primary power available, class of service to be furnished, and construction and operating economies. Where climatic conditions and the location of improvements adjacent to the substation permit, the out-of-doors type of station is used, thus saving the cost of a building to house the heavy equipment.

The development of self-contained, factory-assembled units, such as outdoor type transformers and voltage regulators and steel-housed switch gear, has reduced the time and cost of erection. The use of outdoor, unit type equipment readily permits of additions, alterations, and removals. The units removed have a relatively high salvage value and can be reinstalled at other fitting locations.

Air-cooled transformers, either self-cooled or artificially cooled with air blasts from blowers, and the lowered cost of the same, have displaced a number of water-cooled transformers. This is especially true at locations where it was expensive and difficult to obtain and maintain an adequate water cooling system. To reduce hazard to employees operating and maintaining the equipment, many safety and interlocking devices have been installed. The elimination, location, and guarding of the high-voltage ex-



Carmel substation, in a setting typical of the region.

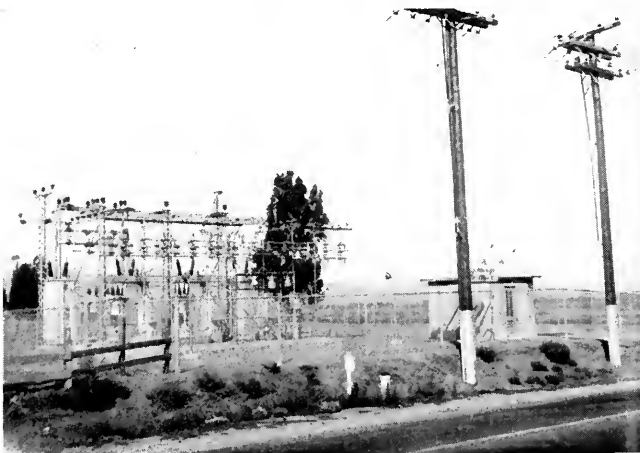
posed parts have been given careful consideration as important factors in reducing accidents.

During the present period of lower costs and with the desire to improve service to the consumer, and to assist in spreading employment, our company has done a considerable amount of work on a number of its substations. In order that the extent and complexity of these improvements may be understood, some of the recent construction work, scattered throughout the system, might well be described.

For many years the requirements for electric power on the Monterey peninsula have been supplied over two 22,000-volt lines running from Salinas to Monterey Substation. In 1930 it became apparent that the capacity

of these lines was being reached and that it would be necessary to make a substantial increase in the transmission facilities for this area. Accordingly a detailed study of present and future requirements was made which resulted in the construction, in 1931, of a third transmission line from Salinas to Monterey to be operated at 60,000 volts. This line was built on steel poles with provision for the installation of a second circuit on the same poles at such time as the load warrants.

A tract of land, about



Los Coches substation, south of Salinas, Monterey County.

half a block in area, was purchased near the eastern limits of Monterey, not far from the Del Monte terminus of the new line, and there the Del Monte substation was established. The site is of sufficient area to provide for the 60,000-volt switching equipment that will be necessary when the second circuit is strung and for the installation of 22,000-volt switching facilities that will eventually make Del Monte substation a switching center for the entire peninsula. The initial installation occupies one corner of the site and consists of a 12,000-kva. bank of transformers with switching gear. Due to the size of the transformers and the somewhat isolated location of the station a 10-ton steel hoist structure was installed to assist in making repairs in case of trouble. The new construction gives to the Monterey peninsula a third source of energy entirely independent of the two older lines, doubles the total capacity available in past years, and assures a continuity of service comparable with other parts of the system.

In keeping with the general growth in load on the Monterey peninsula, the transforming capacity and the distributing facilities at Carmel substation were increased by the installation of a larger bank of transformers and related switching and regulating equipment. This attractive little substation, almost concealed in the tall trees, will now furnish a greatly improved service to the Carmel Valley and Carmel Highlands.

Several other items of construction in the Coast Valleys Division were completed. Installations of new and larger feeder equip-

ment were made at the Chualar, Moro Cojo, Greenfield No. 1, and Gonzales substations. At Soledad a new high-voltage oil switch was put in service.

Los Coches substation, about 28 miles south of Salinas, was built in 1932 to replace an older station constructed a number of years ago by the Coast Valleys Gas and Electric Company. With continuing growth of the agricultural and domestic load in the Salinas Valley, it became necessary to increase the capacity of the original substation to meet the requirements. A study of the conditions in the vicinity of this station led to the conclusion that the load could better be handled from a new location about a mile south of the old station, since the property on which the station was located was neither adequate nor suitable for expansion.

A new site, aggregating about an acre and located on the east side of the state highway as close as possible to the theoretically correct location, was purchased. This area is adequate for any expansions which can be reasonably expected in the future.

The new station is of the completely outdoor, unattended type, which has proven extremely satisfactory and economical in the supply of rural loads in this part of the state. The installation consists of a 60,000-volt oil circuit breaker on the high voltage side of the transformer bank of four 1000-kva. transformers, stepping down from 60,000 volts to 4000 volts; a bank of voltage regulators for maintaining a uniform voltage on the 4000-volt bus; and three oil circuit breakers

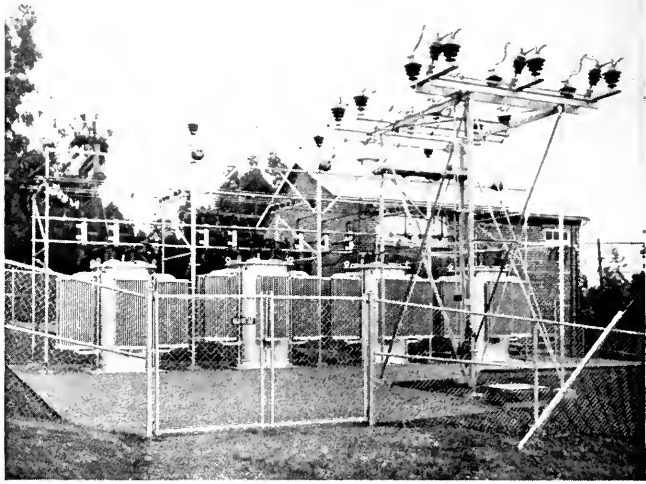


Point Bolinas substation. R.C.A. transmitting station in the background.

supplying three 4000-volt lines, two leading north and one south from the station. A small building houses a switchboard for the control of the 60,000-volt oil circuit breaker, a control system storage battery, and a telephone, and furnishes storage space for station supplies and tools.

The entire arrangement of equipment is based on the utmost economy, consistent with the maintenance of the class of service required. Los Coches substation is typical of a number of similar stations built during the past few years during which experience has shown the advantages of a type of construction particularly adapted to the requirements of rural loads.

In the vicinity of San Francisco Bay a number of important substation problems were solved. A modern, industrial, outdoor type substation with no exposed live parts was installed at the Sunnyvale Naval Air Station in Santa Clara County early in October, 1932. This station has a connected load of over 2300 horsepower, the greater portion of which is supplied at 2300 volts. This station furnishes the permanent power and lighting requirements of the United States



Substation on Hercules Powder Co.'s property near Pinole, Contra Costa County.

Navy's home for dirigible aircraft on the Pacific Coast, and speaks well for the dependability of "Pacific Service." The Government's plant at this site consists of twelve reinforced buildings for housing offices and personnel, supply depots, shops, helium storage, and treatment plants. There are also two deep-well pumps, each operated by a 100-h.p. motor, a 100,000-gallon elevated water tank, a 5,000,000 cu. ft. holder for helium, and last, but not least, the main hangar building. This building is over 200 feet high and 1200 ft. by 300 ft. in area. It

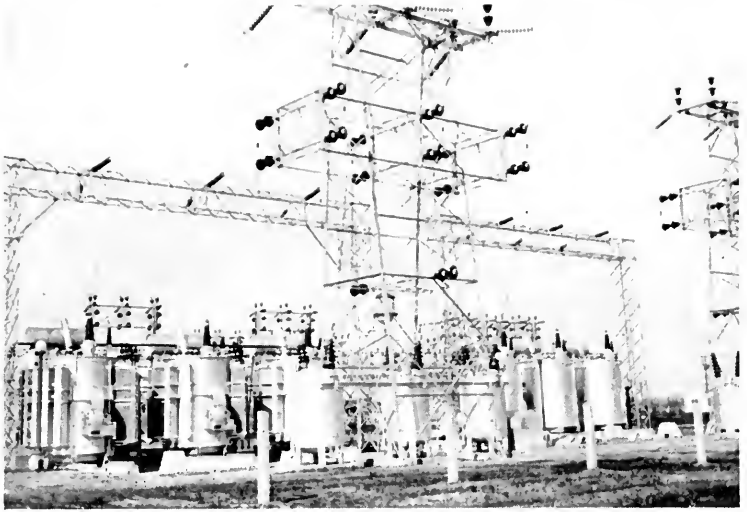
is of especial interest in that the doors in each end open to the full size of the building. Each door is operated by a 250-h.p. motor. The importance of dependable electric service at this location cannot be over-emphasized as it must be ready to operate all facilities at all times without fail. In order to insure this service our station is fed by a



Substation at Avon, in Contra Costa County, supplying power to the Associated Oil Co.'s refinery.

separate line at 11,000 volts from the nearby Mountain View substation with switching facilities for emergency connections to San Jose or Campbell substations.

The new Bolinas substation is illustrative of the various and sometimes special classes of service which are furnished from the Pacific System. This substation, with a 60,000-volt supply line, was constructed to meet the increased requirements of the Radio Corporation of America in its Point Bolinas radio communication transmitting station. The illustration shows the Pacific Gas and Electric Company's Bolinas 60,000- to 11,000-volt step-down station in the foreground and the Radio Corporation's transmitting antenna masts in the background. The Pacific substation is located at a sufficient distance from and supplies the Radio Corporation transformers through 11,000-volt underground cables, to avoid any inter-



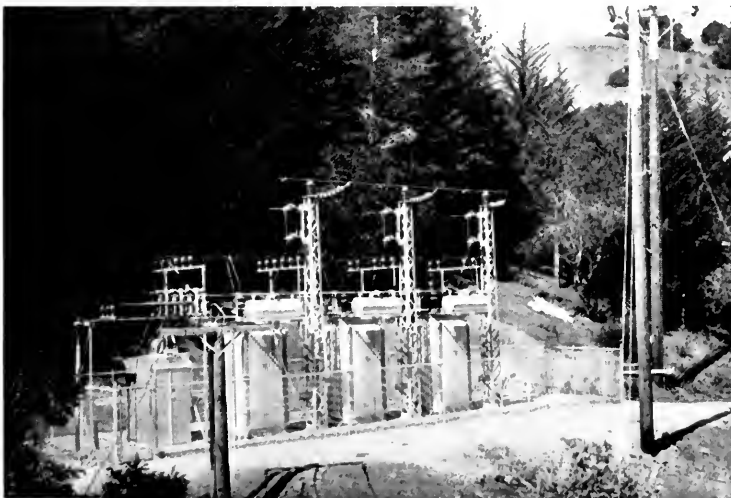
Transformer bank and switch equipment, Contra Costa substation, near Antioch.

ference between the power and radio systems. The transformer bank consists of four 400 kv-a. self-cooled, outdoor type, reducing the voltage from 60,000 to 11,000 volts. Automatic voltage regulators and automatic reclosing type oil circuit breakers are installed. The automatic reclosing circuit breakers can be operated by remote control from the R.C.A. switchboard in their transmitting station, if required.

The Radio Corporation availed itself of the experience of the Pacific Gas and Electric

Company's organization in having the Pacific Company construct its 11,000 to 220-volt step-down transformer station, adjacent to its short-wave radio transmitting station.

Traveling San Francisco bayward, the increase of load, coupled with the need for improved service from the Vallejo Electric Light and Power Company, required that company's construc-

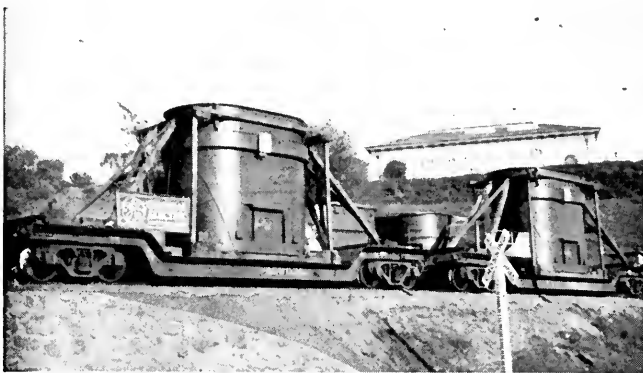


Our substation at Crystal Springs, San Mateo County.

tion of a new, modern substation at Vallejo, and the Pacific Company's increasing its transformer capacity by 2500 kilowatts.

Even so distant a project as the Hoover Dam has its effect upon "Pacific Service," through the increase of the production capacity of the Hercules Powder Company's plant near Pinole, in Contra Costa County. By reason of extensive additions and changes in the plant, it was found necessary to reconstruct and enlarge the substation there and improve its source of power. The reconstruction of this station and its lines was accomplished with practically no interruption to the Hercules Company's operations.

Within the city of San Francisco also, additions and alterations were required in several substations. One of the most interesting, although difficult, reconstruction jobs is in progress at Station "I," located on Eighth and Minna Streets. This station is in the center of the city's distribution network, and is also an important source of power for the street railways and down-town load. It became apparent that it would be necessary to increase the rupturing capacity of the oil circuit breakers, rearrange the 11,000-volt cables and change the relaying system at this station. In statement the job seems simple,

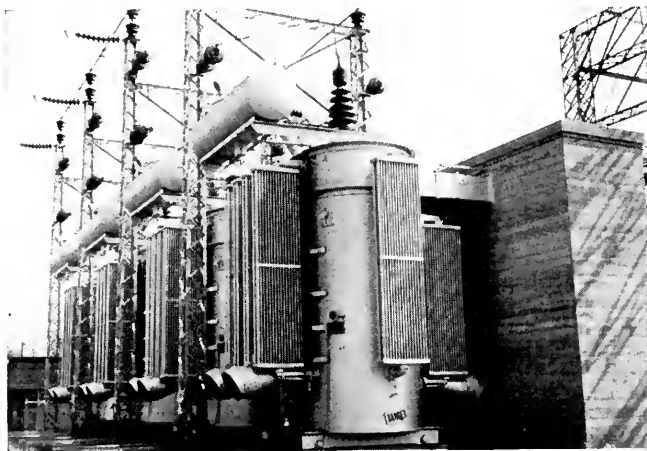


Hauling transformers to Claremont Station. No light job.

but on the contrary it is quite complicated on account of the necessity of maintaining uninterrupted service on the lines and apparatus. This required the preparation and carrying out of an exact schedule of construction operations, in which each change must be anticipated, planned for, and made in logical sequence.

It is of interest to note that when the station was extended several years ago, it was found desirable to install air-conditioning apparatus. This subject is now being brought quite forcibly to the attention of the industrial and commercial world and the home builder. The air-conditioning equipment is located on the roof of the building and draws air into the washer by means of motor-driven fans, where it is cleaned and cooled and then forced through ducts to the various parts of the building. The conditioned air helps keep the machinery cool and clean, thus reducing the maintenance work on the equipment and the janitor work in the station.

In Stockton, Station "A" has recently been reconstructed to accommodate the increased voltage of its incoming lines, made necessary by the growth of requirements at that center. Furthermore, this concentration of service at Station "A" permitted the abandonment of Station "B" in the west section of Stockton, as a distributing station.

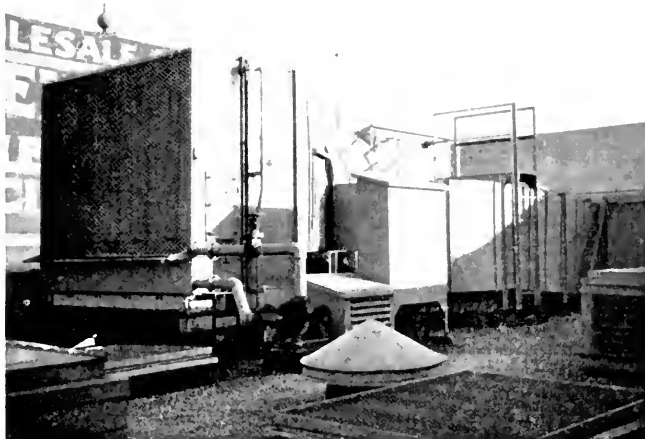


Bank of three 10,000-K.V.A. transformers installed at Station "A", Stockton.

Lodi substation, as the name suggests, is located within the city of Lodi near the northern boundary line, and may be easily observed as a person travels along the new Cherokee Lane between Stockton and Sacramento. The original substation at this location was built many years ago by the Western States Gas and Electric Company, but as the demand for power increased and the widening of the highway encroached upon the area occupied by the terminal poles in front of the station, it was found necessary to completely rebuild this station.

The former station supplied power to the surrounding agricultural area at 4800 volts and to the power system of the city of Lodi at 2400 volts. In planning the new station, it was found advantageous to take care of the power requirements of the territory more distant than that served by the existing 4800-volt system. Accordingly, equipment was installed for delivering power at 11,000 volts. By the addition of this third voltage it was possible to defer making additions to the neighboring substations until some later date.

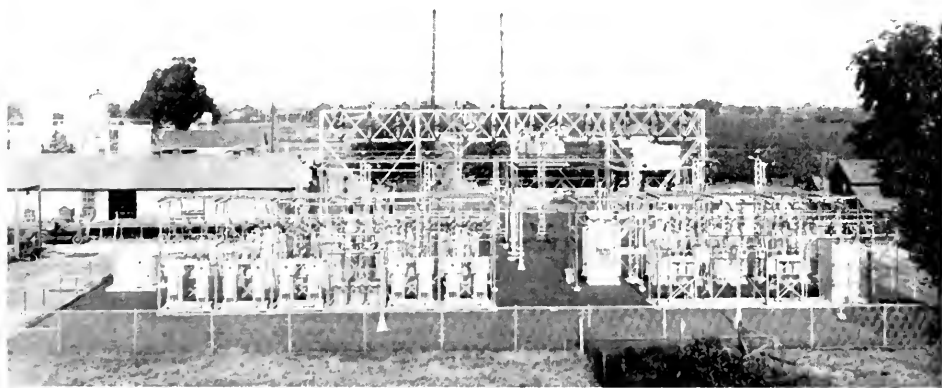
To improve service and supplement the power supply to the Marin and North Bay areas, additional 60,000-volt lines were constructed. Improvements were also made to the Ukiah, San Rafael, and St. Helena substations. At Yountville, the old station was



Air-conditioning equipment on roof of Station "I", San Francisco.

replaced by one of higher voltage and automatic in its operation. The northern part of the system has had its part as well in the substation program. A new substation at Redding has just been completed, which concentrates the facilities for serving the city of Redding and permits the removal of the old Jenny Creek and Redding substations. This is of the most modern outdoor type, with adequate provision for expansion. The design is such that it will operate without attendance.

Improvement work such as that outlined herein is a never-ending task with our company in its obligation to extend its facilities and better its standards of service to the consumer, in view of constant territorial expansion resultant from an increasing population, to say nothing of the broader applications of the commodity at the consumer's disposal.



Our Company's new substation at Lodi, between Stockton and Sacramento.

# An Aerial Venture—Painting Our Carquinez Strait Cables

By R. A. RANSDALL, Assistant Engineer of Line Construction

Our company's aerial power-carrying cables which span Carquinez Strait, at the upper end of San Francisco bay, have recently been re-painted.

Just another paint job, involving the use of an ordinary brush and a can of paint. Nevertheless, it was an unusual job, seeing that it meant working from a little trolley-car suspended at a height of 208 feet above the waters of the bay. Furthermore, this picturesque form of aerial exercise occupied the painter-man nearly four months, working eight hours a day and five days a week.

This accomplishment carries us back to the beginning of the present century, to the very earliest days of hydro-electric development in California, when hydro-electric power generated in the far-away mountain streams was first transmitted to the centers of distribution around the bay of San Francisco. This was done in 1901, when the Bay Counties Power Company, a predecessor of PACIFIC SERVICE, constructed a 60,000 volt tower line from its Colgate plant, on the Yuba river, to Piedmont substation at the head of Lake Merritt, in Oakland. This, at the time, was the highest voltage of any long-distance electric transmission line in the United States. The experiment was successful, but its carrying out involved many serious problems, the most important of which was that of transmitting the power across San Francisco bay. After much discussion, it was decided to do this by aerial cable, and the narrow reach called Carquinez Strait was selected for the purpose.

Many of our readers are familiar with the details of this spectacular construction feature and the improvements made, from time to time, since its original installation. The high-tension transmission lines were brought from the Yuba river across country by way of Wheatland, Woodland, Davis, Dixon, Suisun, and Cordelia to Dillon's Point, an eminence on the north or Solano county shore of the bay about 100 feet above water-level. There a 224-foot steel tower was



The South Tower, on the Contra Costa shore of the strait.

erected and from it four cables were strung across the strait to another tower, called the South Tower, erected on a bluff above Port Costa on the Contra Costa county shore. The original height of this tower was 64 feet, its location being at a much greater elevation from the bay waters than that of the North Tower.

The actual horizontal distance between the towers was 4,427 feet, but the natural sag of the heavy cables called for an additional

length of 55 feet, or 4,482 in all. Two cables were placed on each side of the tower twenty feet apart in a vertical plane, and the lowest had to maintain a sufficient height above the water to allow for the passage of the tallest-masted ships. The actual clearance of the lowest cable was set at 208 feet. Then, these cables had to be securely anchored on both side back of the crossing towers and while a distance of 125 feet was found sufficient for the purpose on the Contra Costa side, the lay of the land on the opposite shore was such that a leaning tower 85 feet in height was constructed at a distance of 1,385 feet from the North Tower to support the cables on their way to anchorages 325 feet further inland.

Each cable, then, was furnished in a piece



Painter starting out on his day's work.

6,300 feet long, weighing 10,269 pounds. It consisted of 19 strands of galvanized plow steel wire, each having a diameter of seven-eighths of an inch and a breaking strength of about 48 tons, equivalent to 215,000 pounds per square inch. The normal strain upon each cable as suspended across the strait is about 11 tons.

The foregoing may be called the spectacular features of this construction. Anchors and anchor stations, insulators and electric substations at either end of the crossing made up the rest.

The project was successful from the first. In the thirty years that have elapsed since the original construction it has never failed of operation, despite the climatic variations to which the bay of San Francisco is subject. In 1915 the increased demand for hydroelectric power in the bay region made it necessary to increase the original installation from four cables—three in service and one spare for emergencies—to a double circuit of six cables. It was a feather in the cap of the engineers who carried out the first construction when, after an exhaustive study of all types of cable suitable for the length of span, it was decided to make no attempt to improve on the original.

In 1924, the Pit river development having been placed in operation, further change was necessary. This time the transmission lines were reconstructed from two 60,000-volt circuits to two 110,000-volt circuits. Anchors were reconstructed and new insulators, saddles and reinforcing cables installed.

But, although these cables are galvanized they cannot be expected to last for all time without occasional treatment. It is necessary, therefore, to paint them at intervals of about



The painter well on his way.

five years. This has always been the job of a steeple-jack; this year, however, it was assigned to the Line Construction Department and it was decided to carry it out with men of our own organization.

The writer, in his official capacity, took a few trips over the cables for inspection purposes and then turned the painting job over to Mr. D. C. Irvine, a lineman, who did the work alone and unassisted except for a man stationed at the end of the crossing whose business it was to pull his car shoreward when the day's work was done. There was no adjournment for luncheon; the painter took that with him in his car.

The car consisted of a working platform five feet long by three feet wide, with a guard rail two feet six inches high. This was suspended from steel cables, three-eighths of an inch in diameter, attached to two sixteen-inch aluminum sheave roller-bearing snatchblocks which rode on the steel cable. A single piece of one-half-inch four-strand hemp rope 2,500 feet in length was used to lower the platform and painter out on the cable. This rope was wound on the steel drum of a hand winch which was operated by a man at the base of



In mid-crossing, 208 feet above the bay waters.

the tower. The rope was passed through a six-inch snatchblock on the top of the tower and then to the working platform. In order that the rope would not sag down or be blown by the wind it was passed through thirty-two small wood blocks to each of which was attached a piece of sash cord five-sixteenths of an inch in diameter and twenty-four inches in length. As the cage was lowered away on the cable one of these blocks was attached to the cable every seventy-five feet.

Although the circuit on which the painter was working was taken out of service the other circuit was delivering power at 110,000 volts. It was necessary, therefore, to keep the one-half inch line well under control, especially when a strong wind was blowing.



A day's work done, the painter makes his way back to the tower.

The first 600 feet out on the cable was down rather a steep grade which would gradually level out until a low point was reached. Since the weight of the man, platform, rope and paint was estimated to sag the cable about twelve feet, there was a place 600 feet along the middle of the span where the car would not run by gravity. It was necessary, therefore, for the painter to pull the car by hand in order to reach the center of the span.

By the time the painter reached this point on his first trip, he had acquired his sea-legs, or, rather, his air-legs. It takes a man with steady nerves, a good sense of equilibrium, a fair sense of rigging and confidence in his equipment, also, perhaps a slight touch of daring, for this sort of work. Mr. Irvine was selected because he possesses all the qualities mentioned, together with over 13 years of service with the company in line construction.

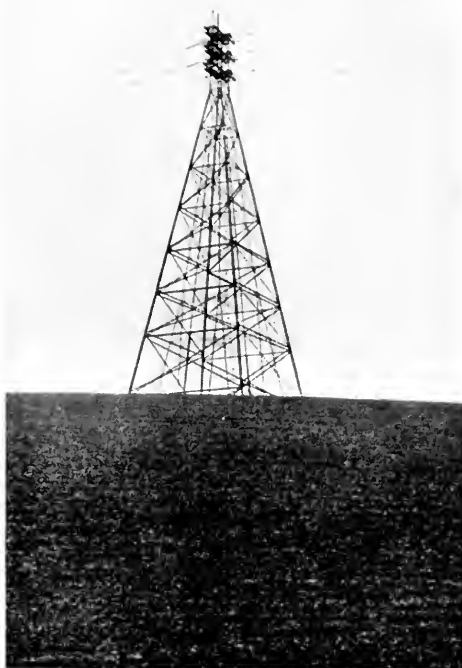
Before starting the day's work the painter loaded his platform with enough paint for the day, two paint brushes, two wire brushes, a scraper, a supply of wiping rags, water bag and his lunch box. He then smeared his face and neck with theatrical cream. Upon reaching the center of the 4,427 foot span he wiped the heavy coat of soot from the cable with a cloth, then wire-brushed the cable until its surface was sufficiently clean to receive the first coat of paint. He would clean and paint about four feet of cable before moving on. Incidentally, the platform being suspended only thirty-six inches below the cable, it was free to tilt at the slightest movement of the painter.

Cleaning and first coat work proved slow and tedious. The first coat was red over a black surface. The change in color insured a complete coverage so that the painter could see the unpainted spots. The second coat was black.

When the day's work was over and the painter wanted to climb back to the tower he signaled the man at the winch to pull him in. When within twenty-five feet of the tower the painter had to leave his car and finish his short but lofty journey in the manner shown in the accompanying picture. A hard day's job, altogether. Working in the wind above and below the wire he would return at quitting time covered with soot. This, however, was easily removed with the coat of theatrical cream.

At the end of each day's work the half-inch line was removed, the platform left on the conductor and all metal parts on the platform were bonded with a piece of copper wire clamped to the cable.

The paint used was a good grade of graphite. One hundred and twenty-five gallons of paint was used. It is worthy of mention that the original paint was removed in places for inspection purposes and the cables found to be in as good condition as when they were



The North Tower, on the Solano County shore of the strait.

first installed. This is remarkable for steel cables exposed to the elements of upwards of thirty years.

Aviators are rated by the number of flying hours to their credit. Painter Irvine is credited with 600 painting hours, 496 of which were passed in mid-air and the balance in painting the structural steel in the anchor houses. One thing the painter was enabled to omit was a "wet paint" sign.

Many changes have taken place since first the Carquinez Strait aerial transmission was installed. The PACIFIC SERVICE territory has been constantly enlarged and valuable additions made to service resources and facilities, to say nothing of improvements in transmission equipment. Nevertheless, our company's modern high-tension substation at Claremont, near Oakland, still receives its daily quota of hydro-electric energy from the mountain power-plants transmitted by way of the Carquinez crossing.



Frederick J. Harris



Daniel H. Pines



Joseph Medlyn



Edward Resbody



Robert C. Hughes



John White



Michael J. Lucey



John J. Mulgrew



Charles R. Maxfield



Frank Uyeda

The "Pacific Service" honor roll. The above pictures are of ten former employees whose long and faithful service has earned them honorable retirement.

## "Pacific Service" Roll of Honor



Heading the honor roll of "Pacific Service" are 135 names of men whose long and faithful service to our company has been rewarded by their honorable retirement with provision for their declining years under our company's pension system which underwent complete revision in the Fall of 1921.

In preceding issues we presented the portraits of men whose names are upon our company's pension roll, accompanied by their several records. In doing this we were actuated by a desire to make our readers acquainted with these men and their records and to point out what is generally recognized in all up-to-date business enterprises, namely, that long and faithful service shall have its reward.

Opposite this will be found another instalment of ten portraits of our company's pensioners. These are:

**Christopher Rozales.** 77 years of age, having been born April 20, 1855. Entered the service of the Monterey County Light and Water Company April 1, 1904, and at the time of his retirement was employed in Coast Valleys Division.

**Francisco S. Vierra.** 70 years of age, having been born December 5, 1861. Entered the service of the Suburban Electric Light Company September 1, 1905, and at the time of his retirement was employed in East Bay Division.

**Joseph Medlyn.** 67 years of age, having been born June 10, 1865. Entered the service of the Pacific Gas and Electric Company in January, 1912, and at the time of his retirement was employed in San Francisco Division.

**Edward Peabody.** 66 years of age, having been born August 15, 1866. Entered the service of the San Francisco Gas and Electric Company November 30, 1907, and at the time of his retirement was employed in San Francisco Division.

**Robert C. Hughes.** 67 years of age, having been born September 22, 1865. Entered the service of the Western States Gas and Electric Company December 1, 1908, and at the time of his retirement was employed in North Bay Division.

**John White.** 66 years of age, having been born February 25, 1866. Entered the service of the Central Electric Railway Company March 2, 1893, and at the time of his retirement was employed in Sacramento Division.

**Michael J. Lucey.** 66 years of age, having been born February 16, 1866. Entered the service of the San Francisco Gas Light Company November 25, 1907, and at the time of his retirement was employed in San Francisco Division.

**John J. Mulgrew.** 65 years of age, having been born July 10, 1866. Entered the service of the Oakland Gas Light Company August 1, 1886, and at the time of his retirement was employed in East Bay Division.

**Frank Uyeda.** 61 years of age, having been born June 25, 1871. Entered the service of the Pacific Gas and Electric Company October 13, 1910, and at the time of his retirement was employed in San Francisco Division.

**Charles R. Maxfield.** 51 years of age, having been born March 11, 1881. Entered the service of the Sacramento Electric Gas and Railway Company July 21, 1902, and at the time of his retirement was employed in Sacramento Division.

## The Financial Side of "Pacific Service"

Following is a consolidated statement of Pacific Gas and Electric Company's income account, including all subsidiary and affiliated companies, for the nine months ended September 30, 1932, compared with the same period of the preceding year:

### PACIFIC GAS AND ELECTRIC COMPANY AND SUBSIDIARIES CONSOLIDATED INCOME STATEMENT, NINE MONTHS ENDED SEPTEMBER 30TH

	9 MOS. ENDED SEPT. 30, 1932	9 MOS. ENDED SEPT. 30, 1931	+ Increase — Decrease
Gross Revenue, including Miscellaneous Income.....	\$64,553,581	\$66,464,242	— \$1,910,661
Maintenance, Operating Expenses, Taxes (including Federal Taxes) and Reserves for Casualties and Uncollectible Accounts.....	27,758,445	28,302,911	— 544,466
Net Income.....	\$36,795,136	\$38,161,331	— \$1,366,195
Bond Interest and Discount.....	12,011,179	11,323,543	+ 687,636
Balance.....	\$24,783,957	\$26,837,788	— \$2,053,831
Reserve for Depreciation.....	8,579,547	8,138,701	+ 440,846
Surplus.....	\$16,204,410	\$18,699,087	— \$2,494,677
Dividends on Preferred Stock.....	6,086,946	6,013,887	+ 73,059
Balance.....	\$10,117,464	\$12,685,200	— \$2,567,736
Dividends on Common Stock.....	9,369,287	9,078,185	+ 291,102
Balance.....	\$ 748,177	\$ 3,607,015	— \$2,858,838

Earnings for the third quarter of the year continued to be adversely affected by general economic conditions. Electric department gross revenues decreased approximately 10%, and aggregate income from all other activities also exhibited some decline, though in a more modified degree. Controllable items of operating cost were substantially reduced, but these economies in operation were in considerable measure offset by larger purchases of power from other producers under existing contractual obligations, and by additional capital charges incident to the larger plant investment.

Net increases in the number of active meters in service in the months of August and September (the first during the current year), and a gradual tapering off during the latter part of the third quarter of the losses experienced in electric department output compared with the similar period of 1931, were encouraging factors.

In the nine months ended September 30, 1932, gross revenues decreased \$1,910,661, or about 3%, and net income available for fixed charges decreased \$1,366,195, notwithstanding which bond interest and discount were earned more than three times. Earnings available for common stock aggregated \$10,117,464, or \$1.62 per share on the average of 6,246,191 shares of common stock outstanding during the period. Of these earnings, 57

cents per share were earned during the first quarter, 52 cents in the second quarter and 53 cents in the third quarter.

The Company continues in a sound financial position, cash on hand at September 30th amounting to \$17,259,189, with no further bond maturities during 1932, and with no uncompleted construction beyond additions and extensions of a purely routine character.

A summarized balance sheet follows:

SUMMARIZED CONSOLIDATED BALANCE SHEET  
OF PACIFIC GAS AND ELECTRIC COMPANY AND SUBSIDIARIES  
SEPTEMBER 30, 1932

ASSETS		
Plants and Properties.....		\$659,575,956
Discount and Expense on Capital Stock.....		407,176
Investments (including Stanpac line).....		5,140,182
Sinking Funds and Other Deposits.....		366,618
Current Assets:		
Cash .....	\$17,259,189	
Other Current Assets .....	15,861,124	33,120,313
Deferred Charges:		
Discount and expense on Funded Debt.....	\$14,474,644	
Unexpired taxes and undistributed suspense items.....	4,438,682	18,913,326
Total Assets .....		\$717,523,571
LIABILITIES		
Common Stock in hands of public.....		\$156,665,307
Preferred Stock in hands of public.....		137,749,332
Minority Interest in Common Capital Stock and Surplus of Subsidiaries.....		215,194
Funded Debt .....		306,433,400
Current Liabilities, including accounts payable, meter deposits, etc.....		3,420,206
Accrued Liabilities, including interest, dividends and taxes accrued but not yet due....		18,080,894
Reserves:		
For Depreciation .....	\$56,925,681	
Other Reserves .....	5,434,995	62,360,676
Surplus .....		32,598,562
Total Liabilities .....		\$717,523,571



## Pacific Service Magazine

PUBLISHED QUARTERLY IN THE INTERESTS OF  
PACIFIC GAS AND ELECTRIC COMPANY

FREDERICK S. MYRTLE - EDITOR-IN-CHIEF

PACIFIC GAS AND ELECTRIC COMPANY  
245 Market St., San Francisco

*The Pacific Gas and Electric Company desires to serve its patrons in the best possible manner. Any consumer not satisfied with his service will confer a favor upon the management by taking the matter up with the division headquarters.*

VOL. XVIII OCTOBER, 1932 No. 10

A decided impetus to industrial development in a considerable section of our "Pacific Service" territory is afforded by the recent official announcement that the Reconstruction Finance Corporation has come to the support of the San Francisco-Oakland bay bridge project through the purchase of \$62,000,000 of its bonds.

This announcement was the result of a thorough investigation of the project by technical experts in the employ of the Reconstruction Finance Corporation followed by conferences between its board of directors and representatives of the trans-bay bridge financial advisory committee, including Mr. Leland Cutler, president of the San Francisco Chamber of Commerce, Mr. Joseph R. Knowland, publisher of the *Oakland Tribune*, and Mr. Harrison S. Robinson, Oakland attorney. The way was cleared for progress when these gentlemen conveyed the glad news to Governor Rolph of California in a message from Washington, D. C.

The construction of a project of this kind cannot help being beneficial to the communities of the bay region. At this time of writing it is reported that bids upon the first steps to be undertaken will be advertised for immediately, while bids upon succeeding steps will follow in order as quickly as is practicable.

In its manufacture there will be needed, according to the estimates of the engineers, 170,000 tons of structural steel and wire, 20,000 tons of reinforcing steel, 200,000 gallons of paint, 40,000,000 feet of lumber, 1,000,000 barrels of cement, 1,000,000 cubic yards of concrete aggregates, large quantities of pipe, electric signals and lighting equipment and approximately \$1,500,000 of construction equipment.

Altogether, the bridge is estimated to cost around \$75,000,000. An important announcement is that approximately 85 per cent of this will be paid out for labor in various parts of the country.

From San Francisco to Yerba Buena Island the structure will be a double suspension bridge swung from four towers 500 feet above the bay. Between the island and the Oakland terminal the bridge will consist of a cantilever section connected with the mole to the north of the Key system pier. The bridge will provide six fast lanes and three slow lanes for automobiles and trucks, also interurban two-track connections. Its length will be four and one-half miles.

The builder of the bridge will be the California Toll Bridge Authority, created by the State Legislature in 1929. Its members are the Governor, the Lieutenant-Governor, the Chairman of the State Highway Commission, the Director of Public Works and the Director of Finance. This body was empowered to provide the necessary funds, while to the Department of Public Works were assigned the design and construction of the project.

Second only in interest is the Golden Gate bridge project, designed to link San Francisco with the north bay counties of the state. For this project a bridge district was formed to include the counties interested. This, too, is a going concern, for satisfactory financial arrangements have already been made for a start upon the work and many contracts have been let. The project has received the official approval of the United States authorities and at the present time plans are in course of completion whereby the communities of the bridge district will bond themselves for its cost and operation. A recent official announcement estimates the total cost of construction, upon the basis of the bids received, at \$23,843,904, a saving of \$668,939 compared with the original bids taken a year ago and later rejected because of delays growing out of litigation.

During the past year there has been completed approximately \$105,000,000 of major building construction in the San Francisco bay area. In San Francisco the list includes the Opera House and Veterans' Memorial Building, progress upon the new Grace Cathedral, the Marine Hospital, the new University of California Hospital addition, San Francisco Health Center and other impor-

tant projects. Improvements designed for the near future include a new U. S. hospital at Fort Miley, a new U. S. Post Office and a new group of Federal buildings for the city's Civic Center.

East Bay Division of our "Pacific Service" territory records the completion of important building projects within the year. Conspicuous among these are the new Oakland Post Office, new construction work at the University of California, Berkeley, and the new Ford plant at Richmond and the new Shell chemical plant at Pittsburg.

In our Stockton territory, the Stockton-to-the-sea project, designed to give the city of Stockton a deep-water harbor, is reported approximately 85 per cent completed. The construction program also calls for the building of docks and other facilities which will make Stockton a first-class harbor.

In the peninsula south of San Francisco an important project is Sunnyvale Air Station, estimated to cost \$5,000,000, which is approximately 75 per cent completed. Other projects of a similar kind are the Army Air Base, in Marin County, and the Army Air Base at Alameda. With the completion of these projects the San Francisco bay region will become the center of Western aviation.

Altogether, there are major construction projects either under way or in contemplation within the confines of our "Pacific Service" territory which represent a total expenditure of \$204,964,151. Of this, total projects either under way or definitely about to start represent an estimated expenditure of \$141,194,651, those depending upon appropriations and further bond issues, \$21,359,500, those depending upon financial and legal action, \$42,410,000.

So, despite the depression which still tends to discourage enterprise all over the country, we are marching on.

At a meeting of business leaders of the Twelfth Federal Reserve District held in San Francisco October 18th, the committee in charge of an industrial rehabilitation program was officially informed that our company is preparing to expend during the next twelve months a sum of \$5,000,000 in the improvement and expansion of its service facilities, both gas and electric.

The details of this program will be made public in due course, but it may be stated now that the greater part of the expenditure will be devoted to replacement of gas mains

and electric lines in many sections of northern and central California, enlargement of transmission and distribution facilities in other districts and extensions to take care of new service demands.

Upon the question of the general policy pursued by utilities such as the Pacific Gas and Electric Company in times of stress we take pleasure in quoting from an editorial in the *San Francisco Park-Presidio Herald*:

"The electric and gas utilities have not been lying down during the depression. To the contrary, they have spent tremendous sums of money in improving and increasing their generating and distributing facilities in preparation for the time when general business conditions will be sufficiently improved for industry to take advantage of the potential service available.

"This is in line with the policy of these two industries, ever since their inception. They have met the demands of the present—and while doing that, have prepared for the demands of the future. They are not content to stand still. They have taken the attitude that the public is entitled to constantly better and cheaper service and each year has been definite progress in both directions.

"There is another important phase to electric and gas developments—their influence in alleviating, as much as single industries can, unemployment. These industries have shown faith in the future during an unusually severe period of stress—a spirit that is in keeping with the pioneer courage that made possible the founding and building of these two great public servants."

In our April issue we presented to our readers a comprehensive explanatory answer to the oft-heard question: "Why should not utility rates decline in proportion to falling commodity prices?" In this we pointed out some of the fundamental differences between public utility business conducted under a system of State regulation and private business enterprise. We called attention to three important facts affecting the rate question with regard to the public utilities: First, that under State Commission regulation utilities are prevented from charging more for their services than will provide a reasonable return upon a fair valuation of their properties devoted to public use, while, on the other hand, unregulated industrial and commercial enterprises are free to charge for their products and service all that can be obtained, the up-

per limit to their price and, consequently, to their profits, being determined by the law of supply and demand; second, that while regulated public utilities have to some degree been benefited by the price decline of the last two years in their operating material and labor expenditures, such lower costs have been absorbed by the decline in receipts brought about by the reduction in the demand for service; third, that an important difference between public utility and private business in times such as the present lies in the fact that private business may, if it will, cease to borrow money, cut expenses to the bone and, if necessary, close up shop to await the return of more prosperous times, whereas with the public utilities their plant investment is continually increasing in the face of falling revenues and they are obligated to continue to maintain adequate service at any and all times and under any and all conditions.

Our editorial appears to have attracted considerable public attention. That our position with regard to this rate question is understood and appreciated in quarters where matters of public interest are publicly discussed is attested by the number of newspaper comments of a favorable character that have found their way to our editorial desk. We quote the following from the *Oakland Inter-City Express*:

"There is misunderstanding at present concerning the electric industry's rates in their relation to existing low price levels.

"What is not understood is that declining material costs are much less important to the electric industry than to other businesses. Electric utilities turn over capital but once in five or more years, where manufacturing businesses turn it over yearly and often in less time. As a result fixed charges, interest, depreciation and taxes vary little for utilities and represent the main cost of conducting the business. They cannot be appreciably reduced during periods when sales are below normal.

"As a matter of fact, utilities have made a better record in maintaining their wage and employment levels than any other major industry during the past three trying years. When output of power is well below normal, utilities cannot close down for a time to cut expenses, as can many other businesses. They

are required to maintain adequate service for those who desire it at all times and under all conditions, whether sales are bad or good. They cannot shut up shop, put what money they have in the bank, and wait for better days.

"This is not to say that electric rates cannot come down. They will come down or go up exactly as they have in the past, based on final cost of operation over a period of time. It is an economic impossibility to compare fluctuation in their rate structure with changes in the price of shoes, clothing, food or other commodities whose turn-over and material cost can be quickly adjusted to meet changed conditions."

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The July issue of PACIFIC SERVICE MAGAZINE was devoted to an exploitation of the business development campaign conducted by our company's Sales Department for the purpose of increasing revenues. This campaign was supported by a comprehensive advertising program actively carried out in all sections of the "Pacific Service" territory. The company's policy in this has received much favorable comment. It is regarded generally as an admirable stimulant to business much needed at a time when the general talk is of depressed business conditions.

The consistent advertising program of the Pacific Gas and Electric Company, coupled with that of local dealers and contractors, has brought to the attention of the people of every community an understanding of the many advantages of natural gas for house-heating.

This has not only been reflected in generally stimulated business, but at least one small manufacturing business has developed into an important industry. Manufacture of gas-heating appliances has kept pace with the rapid growth of the use of natural gas and northern California manufacturers have supplied the need for part of the thousands of gas appliances installed throughout the territory. For the manufacture of these appliances, hundreds of thousands of dollars' worth of materials and local labor are required. Heating contractors and dealers have benefited by the increase in their business through sales of appliances and their installation.

# PACIFIC GAS AND ELECTRIC COMPANY

A CALIFORNIA CORPORATION

Managed by Californians

Operated by Californians

THE CONSOLIDATED "PACIFIC SERVICE" SYSTEM REPRESENTS (as of June 30, 1932)

11,969 employed in all departments (average for 12 months).

\$660,000,000 capital invested in gas, electric, street railway, steam and water plants.

89,000 square miles of territory in which it operates—an area greater than that of England and Wales.

90,000 stockholders.

46 counties of the State in which it transacts business.

1,249,850 consumers served with gas, electricity, water and steam.

2,760,000 people in 46 counties, which is approximately 50 per cent of the State population.

618 cities and towns in which it supplies service directly and through other companies.

\$21,952,000 annual wages paid employees, year ending June 30, 1932.

\$9,727,600 taxes, Federal, State, county and local, year ending June 30, 1932.

1,178,477 horsepower developed in 50 electric water-power plants.

510,187 horsepower developed in 15 electric steam plants.

1,688,664 total horsepower developed in 65 plants.

3,182,952,745 kw. hours sold, year ending June 30, 1932. This is equivalent to the effort of 10,610,000 men.

33,198,040,500 cubic feet of gas sold, year ending June 30, 1932.

34,522 miles of electric transmission and distribution lines. Greater than the distance around the earth.

7,152 miles of mains used in distributing gas. Greater than the distance between San Francisco and Oslo, Norway.

973 miles of canals, ditches and mains used for power and water supply.

1,370 miles of track of railway supplied with electric power.

665,624,794,000 gallons of water storage capacity of 136 lakes and reservoirs. This amount of water would supply the City of San Francisco at the present rate of consumption for approximately 36 years.

215,543 acres of land owned in California.

643 parcels of property owned in cities and towns.

563,634 horsepower in agricultural motors depending on "Pacific Service."

1,143,506 horsepower in mining, electric railways, manufacturing and other motors depending on "Pacific Service."

3,674,025 horsepower connected to system.

PACIFIC GAS AND ELECTRIC COMPANY

General Offices: 245 Market Street

San Francisco

Branches in all principal cities and towns of 46 counties of Northern and Central California.

# STANFORD UNIVERSITY STADIUM

...filled to overflowing  
would not provide  
seating capacity  
for our  
**94,000**  
stock-  
holders



The  
savings  
of this  
multitude  
of investors,  
and of other  
thousands own-  
ing the Company's  
bonds, are invested  
in the properties of this,  
the largest public utility  
enterprise on the Pacific  
Coast, and dedicated to  
the service of homes and in-  
dustries throughout Northern  
and Central California.

**PACIFIC GAS  
AND ELECTRIC COMPANY**  
245 Market Street, San Francisco

# PACIFIC SERVICE MAGAZINE



CARIBOU POWER PLANT  
ON THE NORTH FORK OF FEATHER RIVER

Vol  
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**APRIL, 1933**

No.  
11

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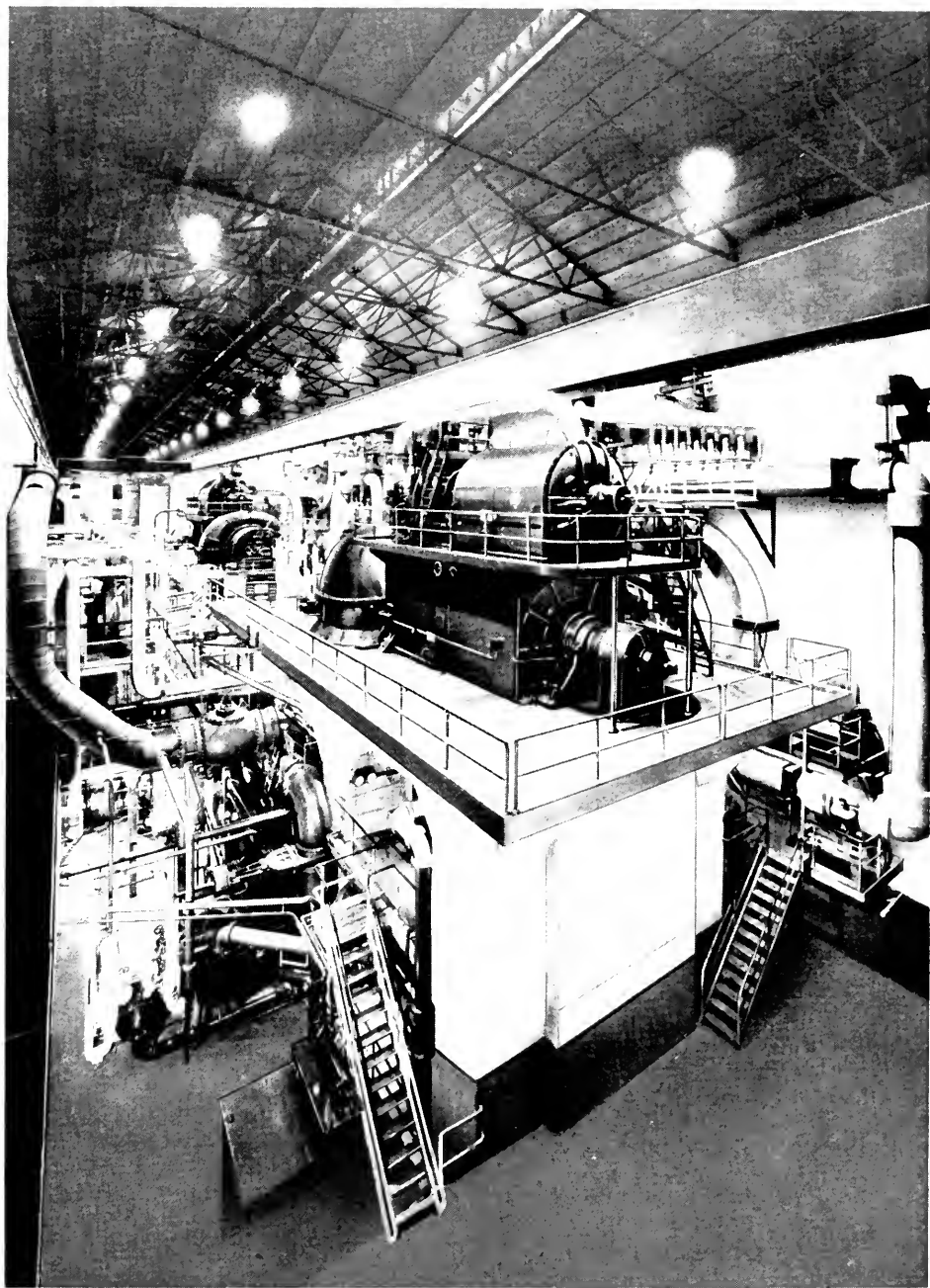
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Turbine room at Station "A", San Francisco, the largest steam-electric station of the "Pacific Service" system. Recently reconstructed and enlarged. Installed generating capacity, 210,000 horsepower. Projected ultimate capacity, according to present plans, 350,000 h.p.

# PACIFIC SERVICE MAGAZINE

Volume XVIII

JANUARY, 1933

Number 11

## *Power in the West—Its Past, Its Present and Its Future*

By FRANK M. HARRIS, *Department of Engineering*

Between the Rocky Mountains and the Pacific lies a great area. One thousand miles in latitude and nine hundred miles in longitude, its 900,000 square miles are apportioned politically among eleven states. Economically, this area is a unit, a veritable Western Empire. The seven westernmost states of the group undeniably belong to the empire in total. Their physical drainage is western through Puget Sound, the Columbia, the Klamath, the Great Sacramento-San Joaquin Basin or the Colorado. In no less measure their trade and economic drainage is Western. Of the four borderland states, it may be said, as in so many other instances, that the economic and physical boundaries are not strictly reflected in their political borders. Their western portions are typically Western, however.

Slowly but irresistibly, since the romantic days of the emigrant train across the plains and the equally romantic days of the emigrant ship around Cape Horn, these eleven states have been laying the foundation of a unified empire. Natural selection from the hardiest and most energetic of the stock of the North and South gave these pioneer men and women unity of type and endurance of fiber.

Since the 'eighties, this physical and mental unity has been welded the firmer by the growth of a community of interest and the infiltration of a sense of political and economic unity. There were joint forestry controls to be established. There were freight rates to be equalized. There were irrigation policies to be co-ordinated. It became almost an axiom that Western problems were seldom solved in the National Capitol. From these conferences and conclaves grew the feeling of an articulated empire, which we discover today still in process of consolidation.

It is rather intriguing that a great expand-

ing territory, such as our Western Empire, experiences the same transitional periods as those through which civilization itself has progressed in its development, from nomadic exploration, through the pastoral, into intensified agriculture, followed by a drift to large urban communities and, finally, an industrial society. This progression has been faithfully followed in the Western Empire, except that the time element has been shortened from eras to decades.

Along the coast and over certain island-like areas in the interior there has been spreading the latest phase of this evolution, that of industrial activity, influenced by the availability of power and transportation. Until the recent period of economic dislocation, it appeared that these industrial areas must continue to spread in keeping with the growth of population, the expansion of manufacturers and the extension of foreign trade, until they came to a nice economic balance with the financial resources and the purchase demands of the region and the export possibilities overseas.

Perhaps the greatest catalytic agent in all this was "power." There seemed to be an economic cycle working, which presented the problem of developing more power, to serve more industries, to employ more people, to utilize more power, and so on ad infinitum. The potential water-power was there; fuel for steam-electric power was there; and the population was coming with new industries in its wake. In discussing the future possibilities of any element in this Western area, the question swings, therefore, with the reliability of the law of gravitation to the general subject of power.

Looking backward, to gain a perspective before attempting to interpret the present, we thus find the electric industry thriving, its output growing steadily. The per capita con-

sumption of power, particularly in California, Montana, and Washington, was the highest in the country, and increasing. Sizeable contributions of capital were being required annually for additions and extensions, to keep pace with the expanding demand for energy.

During 1931, in response to the country-wide cessation in all forms of economic activity, particularly industrial, the usual increase in power output first slackened and then ceased, though slight gains continued to be shown on the Pacific Gas and Electric Company's system by reason of local climatic conditions. Throughout the second half of the year a gradual decline in demand was recorded, but decidedly less than that experienced in other parts of the country.

With particular reference to the "Pacific Service" system, the year 1932 was one of poise, the output for December, 1932, nearly equalling that of December, 1931. The usual summer peak was relatively flat, however, in the absence of a normal irrigating load following a wet winter. If the electric output may be taken as a barometer of economic conditions, one is prompted to draw the conclusion that the liquidation of our local activities must be substantially completed, and that the next trend will be toward improvement.

The improvement, when it does come, may start from the low point in the depression sag and climb slowly at a rate of growth such as has been experienced in the past. On the other hand, there may be an actual recovery of part of the losses of the past two years by a somewhat more rapid rise of the curve toward the position which it would have occupied, had the depression not intervened. An equally academic argument may be presented for either theory, but practical proofs are, of course, lacking. Without embracing either belief specifically, there may be discovered certain favorable factors at work which can only be taken to mean an increased utilization of electrical energy, and its continuation in a position of economic importance.

Estimates of the future electric power requirement of any area, small or vast, are most frequently predicated upon future population, coupled with future per capita consumption, for want of better yardsticks. Population, as a measuring stick, can be nothing better than a prophecy itself, based upon past performances, and with a reasonable justification of any influencing factors which

may have had their effect.

The typical growth curve for population is in the form of a rather flat reverse. Beginning with a slowly rising line, it increases its rate until it reaches its maximum acceleration at mid-height. Beyond that point, it continues to rise, but at a constantly slower rate, gradually flattening until it becomes horizontal at the saturation point. Such a curve, curiously enough, is equally characteristic of bacterial growth, automobile registration, railroad traffic and practically all variables having a biological component.

If we are content to accept the labors of the Bureau of the Census and plot and extrapolate population curves, we find it reasonable to prophesy a considerable increase in this Western Empire during the next decade or two. Many economic and physical intrusions might, of course, have place before then, any of which would boldly disturb the rate or uniformity of growth. The discovery of a new oil or mining field, the subdivision of large land holdings, or the opening of new industrial activity in any one of the eleven states would initiate upward trends.

The appearance of a retarding element would be more unusual. Even the present economic disorganization has not served greatly to affect the rate of immigration into the Western states. To the contrary, the fact that California and the whole Pacific Coast has thus far fared better during the past three years than have other regions, may invite more rapid immigration.

The present density of population in the eleven Western states is but 9.2 persons per square mile, as compared with a density of 80 per square mile over an equal area, between the same latitudes, along the Atlantic coast line, not to mention Rhode Island's 563, and Massachusetts' 512 per square mile. One outstanding deduction to be made from this density situation is the striking immaturity of this Western country. In the presence of such youthfulness anything may be expected in the matter of population expansion.

With this growth of population must come at least a proportional growth in power demand. With power distributed so readily at hand, and at rates as low as are to be found anywhere in the country, it is most improbable that the per capita utilization of power will ever be less than it is at present. To the contrary, it has been the experience with all utility services that requirements increase more rapidly than population.

The domestic application of electricity touches all of us. Nowhere is there greater domestic utilization than in the West, and this use has increased slightly even during these depression years. The large electric equipment manufacturers are anticipating increased demand during the coming year for domestic appliances of all types, refrigerators, space heaters and the like. Industrially, electric power demand must grow at least as fast as the industries which will be coming with population increase. This will not be apparent, however, until industrial activities again start upward toward what has heretofore been considered "normal."

Agricultural electrification, it is anticipated, will maintain its lead and will doubtless be accelerated by the subdivision of large holdings and the intensification of farming. Commercial lighting requirements are largely a function of the concentrations of population in urban centers. As our Western States develop, an increasingly larger proportion of their citizens will be found in cities, with a corresponding influence upon the commercial lighting load.

In addition to these well-known fields of electric utilization, there are new adaptations which are in no wise reflected in the output figures of twenty or thirty years ago, from which we have carried forward our estimates. Except in the Northwest, railroad electrification has had but little effect on electric loads, but it may be expected to play an increasing part during the next twenty years. In fact, many economists consider the electrification of the railroads essential to their continued operation. Highway lighting of main trunk roads for night driving is a not too remote prospect. Airway lighting will undoubtedly assume a prominent place. Domestic air conditioning is just being launched. Experimental work with soil warming is showing promise in specialized horticulture. Another decade will see many further innovations.

For the immediate future, the greatest effort will be directed toward reviving the reduced domestic and industrial loads and toward securing the two years' increases in

demand which should have come upon the systems. It will not be necessary to prove the utility of electric energy to those who have heretofore employed it but whose demand has, for the present, been lessened by reason of economic conditions. It will be necessary, however, to prove the economies of electric power to new users. In this the technical representatives of the power companies will be most helpful in furthering business and industrial recovery.

With a somewhat longer ranged view, and the return of improved conditions, the power industry will still be found at the center of an increasing domestic-industrial-agricultural activity in which it has played an important role. Additional distribution and transforming equipment will be needed, to be followed by transmission and generating facilities when the present plant is fully loaded.

Thus far little has been said of the reaction of adequate power facilities and their expansion upon the economic and social structure of this Western Empire. Payrolls lie close to the foundations of economic and social welfare. When the sums which have been expended and which will have to be expended a few years hence for Western labor and Western materials are considered, the far-reaching effects of even a conservative power program are obvious. To these figures should be added the sums to be invested by individuals in house-wiring and appliances, and by electrical contractors and manufacturers who supply equipment for the industrial utilization of power. These are indefinite as to amount, but there is no question of their influence, in the continuing development of the territory.

Despite the somewhat disturbed situation at present, it is felt that the orderly processes and tendencies which so strongly marked the past will be found to continue in the future, and that the people of the Western Empire will proceed on their power job, with the same positive drive that their predecessors showed in crossing the Rockies and in rounding the Horn.



## Volcano, Historic Mining Town, Now Enjoys "Pacific Service"

By *WARD C. SCHAFER, San Joaquin Division*

Memories of early mining times<sup>a</sup> on the Mother Lode were acutely revived December 3rd last when Volcano, in the pioneer days an active and fairly prosperous mining settlement but of late years irreverently styled the ghost town of Amador County, was for the first time in its history afforded electric light and power service.

Pacific Gas and Electric Company rendered this service by the construction of a 17,000-volt line from Jackson, the county seat of Amador, along the Alpine Highway through Pine Grove. Volcano nestles in the

hills about two miles west of the highway; distance from Jackson, ten miles.

The old town woke up from its long sleep with a grand celebration in honor of the event. Not only did its population turn out en masse but men and women drove in from Jackson, Sutter Creek and all the surrounding communities to swell the local gathering. The town was ablaze with decorations of all sorts and the climax was reached at night when the precious light was flashed on from festoons of electric globes strung along the streets. The evening program included a

grand "electric dance" in Armory Hall, famous for having housed the Volcano Blues, a military organization of the Civil War days. There followed a midnight supper in the old brewery building which dates from 1856. Few of the participants sought their rest before the early hours of the following morning. Mr. W. E. Eskew, our company's district manager at Jackson, and Mrs. Eskew attended the celebration as guests of honor.

Volcano is located on Sutter Creek, 12 miles above the town of that name. It apparently took its name from the adjacent lava flows, for there have been no volcanoes in the neighborhood for untold geological ages. Unlike Sonora, Columbia, Angels Camp and other famous '49 mining camps, the early written history of Volcano is very meager and what exists is obscured by the contradictory reports of living eye-



Volcano, ancient town of the Mother Lode.

witnesses. An anonymous historian who landed in Volcano in 1850, writing in the "History of Amador County," published in 1881, states that the old Methodist church there was built by a man named Davidson who held the first religious services in the Jerome, Hansen and Smith store in 1850. Local lore, to the contrary, has it that the church was built for Thomas Starr King (1824-1864), famous abolitionist of the Civil War days, who is authoritatively given credit for having held California to the Union cause. With a wealth of detail it is told how his first meetings were held under a huge pine tree on the hill behind the straggling town; how they were attended by all creeds, races and colors; how, through the persuasion of Starr King's genial personality, a subscription was



Consolation Street, showing the welcome power lines.

taken up and the church built. Contemporary residents point with pride to the fact that Thomas Starr King and Father Junipero Serra are the only two Californians to have their statues in the Hall of Fame at Washington.

However, none of Thomas Starr King's available biographies mention his ever having been in Volcano and, since he was not only an avowed Unitarian but an acknowledged leader in that thought, a cynic might doubt his having been so influential in establishing a Methodist church. The reader may take his choice between the two conflicting accounts.

Early records apparently establish the fact that white men first came into Amador County in 1846 when Sutter, together with a party of Indians and a few white men, sawed lumber for a ferry boat on the ridge between Sutter and Amador Creeks, about eight miles below Volcano. The first settlers on the present site of Volcano were two of Col. Stevenson's soldiers, who built two huts in Soldiers Gulch. In the spring of '49 a party of men found two dead bodies in the huts and buried them on Graveyard Hill. In 1862 a spring freshet tore away part of the hill and uncovered the bodies, which were reinterred in the present burial ground.

William Wiley is credited with having driven the first wagon on to the present site of Volcano. He was one of a party of eight from Dayton, Illinois, consisting of John Green and his sons, Joseph and Jesse, Erick Erickson, Torkle Erickson, Charles Ewa-

**83 Years** With **COAL OIL LAMPS** Since the **Days of 49**  
ELECTRICITY is here. The P. G. and E. Co. have just completed the line into PINE GROVE and VOLCANO and there is GREAT REJOICING among the People of this Vicinity and will

**CELEBRATE**  
with a

**GRAND ELECTRICAL DANCE**  
IN THE HISTORICAL TOWN OF  
**VOLCANO**  
**SAT. NIGHT, DECEMBER 3**

**A NIGHT OF WONDERMENT**  
NEVER SEEN IN A VOLCANO COUNTY SHOW  
THE HALL WILL DAZZLE WITH BEAUTY INSIDE AND OUT  
YOU WILL BE ELECTRIFIED WITH AMUSEMENT  
Punctuated Searchlights with Tremor your way into the city of Volcano

MUSIC BY  
**Foster and Marks Augmented Orchestra**  
SPECIAL FOR THE OCCASION

DANCE TICKETS \$1.00 LADIES FREE  
Supper in the old Volcano Brewery Bldg. just across the street

Poster announcing the celebration.

banks and Jackson Beam. Soon after the arrival of the Green party, Jacob Cook also arrived at the site with a wagon and the number augmented until, by the winter of '49, Volcano boasted a population of 100 persons.

The Green party went to work on a claim that they had staked out in a red clay wash and at a depth of eight feet came upon gravel that was so rich that they could "pick out gold with the fingers." They were said to have averaged about \$100 a day to the man. This same piece of ground was worked continually for thirty years and produced in the neighborhood of a million dollars. This ground was afterwards known as the "Georgia Claim," and it was apparently here that the application of power to unwatering was first applied. A gallows fifty feet high was erected and a pine log hung on it like a pendulum. The partners worked the pendulum by day and a burly hanger-on was hired to keep the mine pumped out at night. The next application of power to replace the crude hand method was made by a Captain Graham, who rigged up a water wheel to run a battery of six rockers. This caused considerable interest through the northern Mother Lode and was credited with being a great stride in mine operation.

Mining claims often changed hands for as much as \$1,000 for a piece of ground 30 feet square. One Moore Lerty is reported to have



The old Methodist Church at Volcano.

been particularly successful in selling claims. It may be that he was the first to originate the popular, but nevertheless questionable process of "salting mines." He would stake a claim, load an old musket with gold dust and shoot as much as \$200 or \$300 into the ground, then he either sold the claim for a high price or retrieved the "salt" by washing.

One of his first customers, Henry Jones, bought a claim from him on this basis, which providentially turned out to be one of the richest in the district. However, several of the claims turned out as might have been anticipated and Lerty was run out of the country.

Hydraulic mining was introduced in the winter of '53 with the use of penstocks made of tin, canvas, riveted leather, hollowed logs, and apparently any other material that was at hand. Soon after this, cast iron pipe was introduced and after considerable experimentation had eliminated the hazard of expansion and contraction, hydraulicking went on to a sound basis. One system installed in 1856 was still working in the '80's.

Volcano apparently suffered more from devastating fires than other of the Mother Lode towns. The first large fire occurred in the fall of 1853. It started

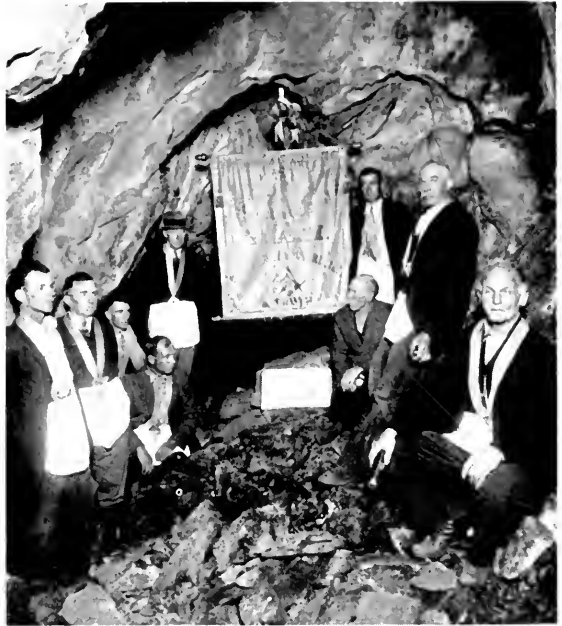


"Old Abe," brass cannon cast in 1837. Mounted for the "Volcano Blues."

in the two-story hotel building and rapidly consumed several adjacent buildings before it was put out by a hastily formed bucket brigade. Probably the worst fire in the history of Volcano occurred in November of 1859 and destroyed approximately \$60,000 worth of property. However, with indomitable spirit the town had the ruined area rebuilt by January of the following year.

An interesting story is told of the burning of Mahoney Hall, which was used at that time as an armory by the Volcano Blues, the organized company of local soldiers referred to above. The flag was flying when the building took fire and in their haste to get in the clear the Volcano Blues overlooked rescuing it. Apparently there was more consternation over the loss of the flag than over the loss of the building. By an act of providence that is even now related in an awed voice, the flag pole burned at its base and fell; the old flag dropped unharmed, with it, to the street below where it was rescued by its loyal protectors.

As the scattered claims either worked out or were consolidated into firm hands, the town began to decline. In the meantime, however, approximately four million dollars had been taken out of the gravel and clay around. In its heyday the town supported five hotels, five blacksmith shops, nine gro-

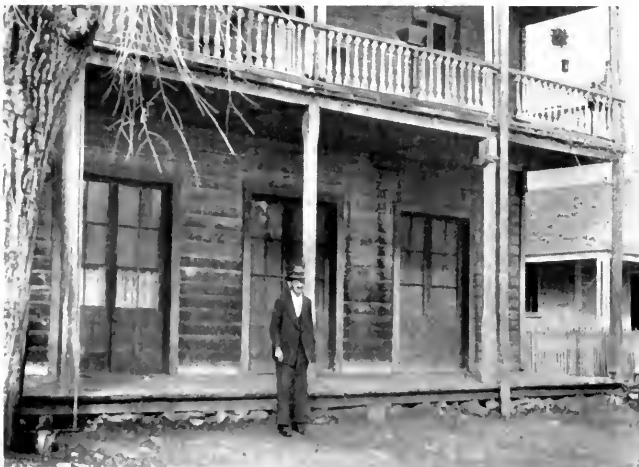


Masonic Cave. Meetings of Lodge No. 56 were held here in the '50s.

cery stores, three butcher shops, three bakeries, two breweries, twelve restaurants and forty-seven saloons. Between '52 and '54 the town had a male population of some 2,000, which included 300 Indians and over 300 Chinamen; the voting population numbered 1,200.

Contemporary residents claim that Volcano once vied with Sacramento in the selection of the site of the State Capitol. While it is true that Columbia was in the running, it is probable that Volcano's claims have been confused with its competition with Lone, Jackson and Mokelumne Hill in the selection of a site for the county seat of the newly formed County of Amador in 1854. In the latter case rivalry ran high and competitive offers mounted until Jackson and Lone offered \$10,000 each toward public buildings and Mokelumne Hill offered \$6,000. The election went to Jackson with a margin of only 60 votes.

By the spring of '52 it



Peter I. Jonas, a resident of Volcano since 1861.

was possible to get up a fairly good dance by impressing the services of the entire respectable female population, including children. It was in 1851 that the first wedding was held, in which Mrs. Henly, who cooked for the Volcano Hotel, married Mr. Hunt. The next united a Mr. Halstead and a sister of the Lewis brothers who arrived early in '52.

The anonymous historian aforementioned declares that Bret Harte and Joaquin Miller and a score of other writers have given us an exaggerated idea of conditions in the early camps. He says their caricature is about as close to the truth as the Indian maiden of romance is to a Digger squaw. We might extend the simile to a moving picture director's idea of cowboy life. The romantic forty-niner is reported to have carried pounds of gold dust in his pocket which he would pass out grandly by the handful for whiskey or whatever struck his fancy, carrying an arsenal of knives and revolvers which he was wont to use on the slightest provocation. The historian says that actually they were sober, industrious and energetic men who toiled as only men with ambition and strength can toil; that the exceptions who have given such a false character to the forty-niner were unprincipled adventurers from every state and nation, criminals, gamblers of bad repute, frontiersmen, who acknowledged no law, and fugitives from justice everywhere.

A substantial, honorable and industrious prospector, when he was lucky enough to locate a paying claim, immediately set up his household and religiously maintained its integrity as any other good citizen would do. Although there are no relics of the first cabins in Volcano today, we can see several cabins that remain from the prosperous days of the early '50's that were built of pine siding with framed and glazed windows. All of them seem to have been well floored.

Concerning the early intellectual life of the town the anonymous historian says that few towns could boast as much talent lying around loose as Volcano. Several cabins in

back of the town housed a number of intellectual lights who daily discussed and solved all the abstruse questions that have since been modestly treated upon by Spencer, Huxley and Tyndal. They wore their old broadcloth into dirty gloss, read all the books and newspapers that could be found and trusted to the generosity of their hard-working friends for an occasional square meal. The roughshod mining camp, however, was not sufficiently advanced to support such an intellectual aristocracy, with the result that this early constellation of stars disappeared soon after '53. It is reported, however, that other intellectuals who were willing to work for their daily bread thrived heartily and eventually carved their names on the honor roll of the State. Among them was Ellec Hayes, who became a brigadier-general and was killed in the Battle of the Wilderness, Sempronious Boyd, who became a Union general and a member of Congress. Mr. Halstead, who carried vegetables on his back over the town, became a distinguished lawyer. Senator S. J. K. Handey, Judge Black, Moses Tebbs and Judge Reynolds were early residents of Volcano and all made their mark in the world. James T. Farley, former U. S. Senator, commenced his career in Volcano. Coming down to later days, Volcano's most valid claim to present distinction lies in the fact that it is the birthplace of Mayor Angelo Rossi of the City of San Francisco.

It is a far cry from the clamorous activity that was Volcano in the '50's to the somnolent village of 1933. Much of the story is lost or obscured by the contradictory reminiscences of the old timers who are all too rapidly passing; the Mother Lode needs a genial Boswell to embalm its past glories in authentic history. One day when its unplumbed resources in agriculture, lumber, mining and a host of other potentialities reawaken this area to an activity far richer in stable wealth than the transitory era of gold, the fact that this history died with those who made it will be a matter of general regret.



# Reconstructed Substation Is Typical of Modern Design

By RICHARD B. KELLOGG, *Department of Engineering*

Due to the continued demand for additional electric light and power in the western part of San Francisco, it has been necessary to reconstruct and increase the capacity of one of our Pacific Service substations, known as Station "G," located on the north-east corner of Ellis and Broderick Streets. Incoming power is delivered to this station at 11,000 volts from Station "A," at the Potrero, the largest steam electric-generating station of our company's system, and from Station "H," just across the San Mateo county line, through which hydro-electric power from Newark is delivered into San Francisco.

In general, Station "G" serves five different purposes in the supply of electrical energy:

1. It serves as a switching station for the 11,000-volt power system in the western end of San Francisco.
2. The Municipal Railway is supplied with 2500 kv-a. of power at 600 volts direct current. Two 1000 kw. and one 500 kw. motor generators are installed for this purpose, serving as conversion
3. It delivers a small amount of direct current power at 125/250 volts for commercial purposes. Two 150 kw. balancers are installed for this service, which is an important factor in maintaining proper voltage on the fringe of our large Edison direct-current three-wire system.
4. Station "G" also delivers energy to supply over two thousand street lights in the surrounding territory.
5. Last but not least, Station "G" delivers 12,000 kv-a. of general power and light to that portion of San Francisco bounded on the west by Arguello, east by Franklin Street, north by Broadway, and south approximately by Market Street, an area of about three and one-half square miles. Ten feeders radiate to all parts of this district in which are business sections, large apartment houses, and residences.



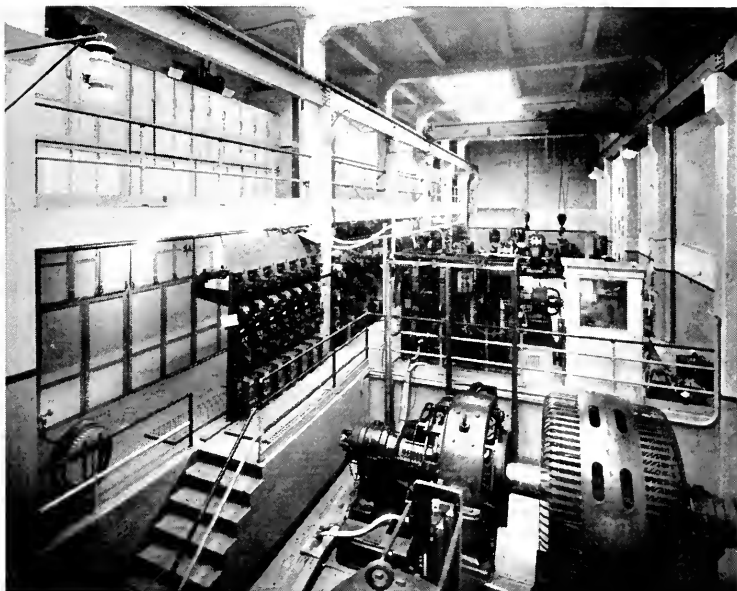
Station "G," San Francisco, as recently reconstructed.

From all this, one can appreciate that although Station "G" is only one of sixteen other stations distributing "Pacific Service" to the people of San Francisco, it is not a small station, either in size or importance of service. As illustrating the congestion in a large city, Station "G," serving only 3.5 square miles, or  $\frac{1}{11}$  of the area of San Francisco, has a possible transformer and feeder capacity of 30,000 kv-a., enough to supply the towns of San Mateo, Redwood City, Palo Alto, and Mountain View, embracing a territory of approximately 75 square miles.

Furthermore, this station, as reconstructed, is of particular interest because of several new and unusual features employed in its design.

The two main rooms in the old building have been converted and will now be used, one for the five rotating machines, 600-volt railway and 250 d.c. switchboards, and the other for the 11,000-volt oil circuit breaker structure and two main power buses. The power distribution transformers, regulators, and 4 kv. feeder structure have been moved to the new addition, leaving sufficient room for future expansion in the older building which formerly housed all the service facilities. In the machine room, there is provision for additional railway service with its associated switching equipment. The 11 kv. switch and bus room will accommodate twenty-three switch positions, an excess of eight over the fifteen positions now in use.

Modern equipment has been installed in the older building and some of the older devices installed twenty years ago have been removed. Three of the rotating machines, formerly two-phase, have been rebuilt for three-phase operation.



Machine room at Station "G".

An addition has been built to the north of the original buildings and the new Broderick Street front has been given the same architectural treatment as the rest of the station, making a uniform structure throughout. The addition is a three-story steel and concrete building about 139 ft. deep and approximately 45 ft. wide fronting on Broderick Street. The ground floor consists of seven rooms. The entrance or handling room is equipped with a 10-ton electric hoist arranged to handle the equipment for all the building on all floors, as well as the transformer cores in event they must be lifted from their cases. Two transformer rooms, 20 ft. in height, house the 5000 kv-a. self-cooled-air-cooled transformers. These step down the 11 kv. supply to 4,000 volts for distribution to the surrounding area, where the voltage is again reduced by the line transformers to the 125/250 house voltage of which we are all familiar. The transformers are approximately 16 ft. high and 8 ft. square and weigh 18 tons each. There will ultimately be seven of these, two banks of 15,000 kv-a. each and one spare.

They are designed to carry approximately  $\frac{2}{3}$  load as self-cooled units depending only on the natural ventilation of the room for cooling, but as soon as the load exceeds this amount, and the oil temperature increases,

an automatic thermostat starts a blower which forces air at 2 oz. pressure against the transformer radiators, thus dissipating the heat and enabling them to carry their full load. If the oil, which is used as an insulating and cooling medium in these transformers, exceeds a given temperature an alarm operates which calls the attention of the switchboard attendant.

The two transformer rooms are equipped with all the necessary piping and devices for filtering, filling, and draining the oil, and with the most modern ventilating ducts and roof ventilators for handling the air required for cooling, which amounts to 10,000 cu. ft. per min. for each room. The rooms are sound-proofed and every precaution has been taken to keep noise from reaching the adjacent residences. Modern "Lux" fire-fighting equipment of the portable type is installed as a precaution against fires.

The remaining ground floor rooms are the oil-room containing a 1500 gal. underground room containing a 1500 gal. underground tank with necessary pumping and controlling devices, the cable room for the 4 kv. outgoing distribution cables, the blower-room, which also is designed for an automatic dry air filter when required, and the control battery room.

The second floor contains the station light and power switchboard and transformer bank and the 4 kv. feeder regulating equipment, together with the 4 kv. all-steel instrument, relay and control feeder panels. There are ten 4 kv. banks of induction regulators and control panels at present, with provision for nine additional when required. The feeders are automatic reclosing and the regulators which are used to keep the voltage constant under varying conditions are in steel compartments, well lighted and ventilated with fresh cool air from the outside. Each feeder has a capacity of approximately 2000 kv-a.

In case some are not familiar with the term "automatic reclosing" as applied to a distribution feeder circuit, a brief explanation may be welcome. The 4 kv. feeders which



4-kv. metal-clad bus and switch structure.

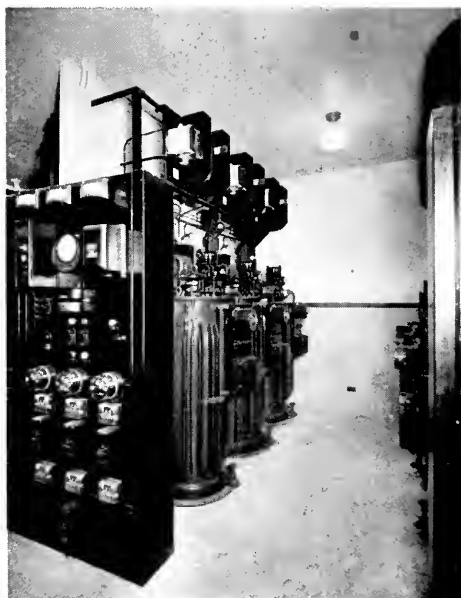
radiate from Station "G" leave the station in underground cables, then rise up a pole and for the remaining distance run on pole lines along the streets. In general, two kinds of trouble may occur on these circuits, permanent trouble and transient trouble. The terms are self-explanatory. Permanent trouble will "stay on" until men go out and clear it, but transient trouble, which is intermittent, may "burn clear" and disappear. Therefore, an ordinary relayed circuit will open and "go dead" on transient trouble which may have cleared up. This condition will leave the customers on that circuit without service until the troublemen make sure the line is good. This takes time for inspection, so, to guard against such delay, the circuits are equipped with automatic reclosing relays that "feel out" the circuit in case it opens and "goes dead." These relays close the line switch three successive times, a few seconds apart, and if the switch stays in it proves the line clear. If the switch persists in tripping, it remains open after the third reclosure and is "locked out," giving the attendant an alarm. This feature improves the service as it keeps the power on unless there is permanent trouble. Records show that 70 per cent of all troubles on this class of service are cleared on the first reclosure.

The third floor contains the operator's control room, locker and wash rooms, and the main 4 kv. double bus, switch, and reactor room.

the operator's control room, locker and wash rooms, and the main 4 kv. double bus, switch, and reactor room.

An accompanying illustration shows the unusual type of 4 kv. bus and switch structure used in this station. It is a modern all-steel, factory-built and assembled unit, comprising twelve 600-ampere, 4000-volt, 3-phase circuits. The only installation work necessary was the bolting down and connecting, minor adjustments, etc. The oil circuit-breakers are of high rupturing duty installed in boiler-steel tanks. They are of the "removable type," which means that they can be raised to the operating position or lowered to the disconnected position by means of a portable electric motor which operates a self-contained elevating mechanism. This feature eliminates the former type of hand-operated disconnecting switches which were necessary in the past in order to clear an oil switch and which proved an operating hazard. Reactors limiting the rush of current which always follows a short circuit are installed in each feeder circuit and form an integral part of the metal-clad structure. This installation is the first of its type to be installed in any of the substations in the bay area. The transformer bank switches are of the same type but of larger capacity and are housed in separate structures near the transfer switch compartments for "cutting in" the spare transformer for the large main banks.

The operator's control room is modern in every respect. The control switchboard is dead front type with flush type illuminated dial instruments, a new feature in San Francisco substations. Another new feature which is the first installation on the Pacific Coast is the 11 kv. operating and control board of the "miniature type." This term means that the instruments and control keys are much smaller than standard and allow two circuits to be installed in the space occupied formerly by one. The control keys and lamps resemble telephone equipment, in part, and the wires connecting this board with the relay board in the main machine room 130 ft. away are run in multiple con-



Feeder regulator bay, with 4-kv. switchboard.

ductor cables instead of installing each circuit in a rigid iron conduit. The miniature type of switchboard saved money both in building space and the cost of iron conduit and separate control wires which would have been necessary with the customary type.

To sum up, the features which help to make "G" an up-to-date station are:

A substantial steel and concrete building, sound and fire proof with furred and plastered walls and ceilings; high efficiency lighting units specially designed to eliminate glare and dark spots; good supply of fresh air at all times, with modern roof ventilators; electric heat where the required heat is not supplied by the apparatus itself; interconnecting telephone system; fire protection; metal-clad bus and switching units of the "removable" type; steel switchboards; miniature direct wire switchboard; steel regulator bays insuring safer operating conditions.

The entire job was designed and carried out by company employees.



## Home Appliance Exposition in San Francisco Civic Auditorium

During the third week of last December San Francisco's Civic Auditorium was the scene of a comprehensive exhibit of domestic appliances, both gas and electric.

The entire main floor of the auditorium was taken up by the exhibit, which was divided into rows through the center of which interested visitors passed up and down. On display was to be found every kind of appliance known to modern manufacture, from the heavier articles such as central furnaces, floor furnaces, stoves, refrigerators, water-heaters, portable heaters, washing machines, and so forth, down to the smaller but equally important articles of use in the household. The whole affair was arranged by men of "Pacific Service" and our company bore a considerable share of the expense. The exhibit was open day and night from Tuesday, December 13th, to Friday, December 16th, inclusive. Company officials as well as representatives of the various manufacturing concerns exhibiting were on hand to give necessary information concerning manner of operating, cost, efficiency and other matters of public inquiry. It was the largest and best thing of its kind ever attempted in the city of San Francisco, and it was estimated that fully 30,000 people availed themselves of the opportunity to see for themselves what modern science was doing to insure home comfort and to ease the housewife's burden.

Devices of unusual popular interest included the electric magic ball that answered questions put by visitors, the "electric eye" that counted visitors as they entered; a device to automatically start and stop electric motors; the world's largest and smallest incandescent lamps, the one rated at 10,000 watts and the other at a small fraction of a watt; last but by no means least, an electrically operated bridge table at which four local experts engaged in a tournament intended to decide between the respective merits of two opposing systems of bidding.

Entertainment of a musical character was furnished by a local orchestra of twenty pieces which occupied the auditorium stage afternoons and evenings.

The week was one of strenuous activity

for gas and electric men of California. Three important gatherings were held at the scene of the exposition. On the evening of Wednesday, December 14th, a gas industry dinner was held in Larkin Hall, a room adjoining the main auditorium, which was attended by 350 members of the industry in the State, including appliance manufacturers, jobbers and dealers as well as representatives of utility companies.

It was the annual banquet of the Pacific Coast Gas Association and the Gas Appliance Society. Mr. R. E. Fisher, our company's Vice-President in charge of Public Relations and Sales, presided and introduced Mr. H. M. Crawford, general sales manager, who delivered the keynote speech. Mr. Crawford told of a survey recently completed by men of "Pacific Service" in the territory covered by its operations and from which it was estimated that the northern half of California offered a \$52,000,000 market for gas appliances. In the way of details, the market for automatic water heaters was placed at \$21,000,000, it being pointed out that fully 250,000 homes in the territory served by Pacific Gas and Electric Company's natural gas system lacked equipment of that kind. The fact that 50,000 homes in that territory still used coal, wood and oil for cooking presented a \$5,000,000 market for gas ranges at an average of \$100 each, to say nothing of replacements among the company's 400,000 gas range users. Then to this potential total of \$26,000,000 for water-heaters and ranges could be added \$26,000,000 representing potential sales of heating equipment. Mr. Crawford told his audience that about one-half of the company's business building program for 1933 would be devoted to a gas sales campaign.

Of equal importance was the electrical dinner held in Larkin Hall on the evening of Friday, December 16th, under the auspices of the Pacific Coast Electrical Bureau. Mr. George C. Tenney, vice-president of the McGraw-Hill Company, publisher of *Electrical West*, presided and again the principal address was made by our Mr. H. M. Crawford, who presented details of a survey



recently made of the "Pacific Service" territory, this time in regard to possibilities in the way of a sales campaign for electrical appliances and equipment. He placed the potential market for electrical appliances and equipment in northern and central California at \$70,000,000. Of this total, \$20,000,000 represented potential sales of electric refrigerators. The electric range and water-heater market was estimated at \$7,000,000, the market for new equipment and replacements at \$8,000,000, the market for industrial heating, air conditioning, lighting and other types of electric service at \$35,000,000.

At both these dinners the announcement was made that during the present year Pacific Gas and Electric Company would actively carry on its business building campaign in co-operation with manufacturers and distributors. The sales force to number 519 company employees and the campaign to be supported by a comprehensive advertising

program. The goal of achievement was set at \$6,482,000 of new business signed up.

Thursday, December 15th, was devoted to an all-day sales convention attended by executives and salesmen from the entire "Pacific Service" territory. In the evening, our company's annual sales dinner was held in Larkin Hall. There was an attendance of 600, including executives, department heads and invited employees, of whom 233 attended as honor guests in recognition of their having exceeded their various sales quotas in the 1932 business building campaign. Mr. R. E. Fisher, who presided, announced that the year's campaign had resulted in the securing of \$9,235,424 worth of new business on the consolidated "Pacific Service" system. This was to be regarded as an excellent showing under the adverse conditions prevailing, although it was unfortunately more than offset by losses sustained through decreased consumption by old customers of the company.



General Manager Downing explained the present situation with a report showing that the consolidated system's electric business for the year ending December 30th, 1932, had suffered a decrease of 12 per cent as compared with the record the preceding twelve months. On the other hand, gas consumption on the P. G. and E. system showed an increase of 14 per cent in domestic and commercial consumption and 17.7 per cent in industrial consumption. These gains had been accomplished by extensive work in the development of new uses for gas. On the whole, however, the company's report for the year would show a diminution of gross revenues as compared with 1931.

On the subject of difficulties encountered in maintaining revenues Mr. Downing cited the fact that rate reductions put into effect since February 15, 1928, had resulted in reductions of consumers' bills amounting to

\$15,900,000 annually. On the gas side, rate reductions, combined with the introduction of natural gas with its heat content more than double that of the manufactured product, had resulted in a saving to gas consumers amounting to \$10,000,000 annually, while rate reductions for electric service had resulted in savings to consumers aggregating \$5,900,000 annually.

President Hockenbeamer made a brief address of congratulation to the honor guests who had "gone over the top." He presented his trophy to San Francisco Division for the best showing made among the territorial divisions of the company during 1932.

The work of arranging and conducting the exposition was carried out by various committees. The executive committee in full charge consisted of Messrs. R. E. Fisher, J. P. Coghlan, A. E. Wishon, H. M. Crawford and A. C. Joy, all of "Pacific Service."

## Our Company Service Groups— *Extensions of Recent Date*

Storage and distribution of materials and supplies, together with maintenance and repair of service equipment, constitute an activity which is vital to our company's efficient operation and to the continuance of a high standard of service to its consumers.

In order to provide adequate facilities for this purpose and to keep pace with the steady expansion of its gas and electric operations, a comprehensive program of service building construction was inaugurated by the company about nine years ago. The most important unit completed under this plan was the Central Warehouse group occupying an area of 12¾ acres in the industrial district of Emeryville.

As its name implies this is the headquarters warehousing group. It controls all of the materials and supplies for the Pacific Gas & Electric Company, performs all major repair work, and rehabilitates equipment returned from different points of the system when suitable for re-use or for sale. The warehouse and shop facilities provided here, and a description of the particular functions which they perform, were discussed in a previous issue of *PACIFIC SERVICE MAGAZINE*. As explained in that article, the control of the storage and dis-

tribution of materials functions through some 200 sub-warehouses distributed at selected points throughout the company's territory.

To present a clear picture of service facility requirements beyond those which the Central Warehouse fulfills, it is necessary to point out that the operating organization of the "Pacific Service" system extends over some 89,000 square miles of territory and supplies service to approximately 1,250,000 consumers distributed among all the principal cities, towns, and hamlets of forty-six counties of northern and central California. To serve its consumers efficiently this territory is divided into twelve separate operating divisions, each with headquarters in one of the major municipalities within its territory. From the Central Warehouse supplies and materials flow to sub-warehouses in each of these divisions, whence they are distributed to their final points of installation in service. The divisions are themselves responsible for the maintenance, repair, and transportation of the equipment and supplies used within their territories. An important auxiliary to this work is automotive transportation. For this purpose, the company operates a fleet of some 1300 motor trucks and 760 passenger cars



San Mateo service group. Garage in foreground.

which are assigned to the different divisions in proportion to their territorial dimensions and volume of business handled. The maintenance and repair of its automotive equipment is also naturally a division function.

At the time the Central Warehouse buildings were completed, many of the existing warehouse and service facilities within the territorial divisions and districts referred to had become outgrown. In order to meet current demands, they had been expanded in most instances by leasing additional quarters, but this often resulted in a decentralization which militated against the most efficient operation and was not conducive to the highest standard of service. This condition was recognized by the management and a Service Group Committee was appointed whose duty it was to survey conditions, determine those localities most in need of improved facilities and to develop a plan of construction which, so far as possible, would centralize all related activities for each division or district within a single group of buildings.

This problem required the planning of buildings and yard storage space to meet the



Service group at Redwood City, San Mateo County.

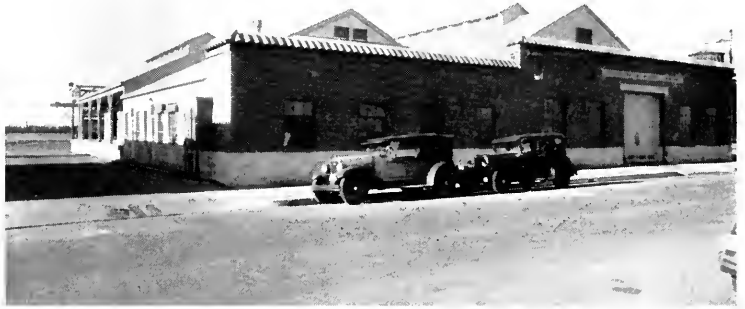
special needs of various individual localities. A standard design could not be fitted to all cases because of differences in the location and dimensions of property available, and because existing buildings and equipment must be utilized in the new scheme wherever possible; nevertheless, certain guiding principles of an ideal arrangement were evolved and an attempt was made to follow them so far as the natural limitations permitted in each case.

The typical arrangement for a completely integrated group of service facilities consists of a central yard for the storage of poles, pipes and other heavy equipment that require no particular protection from the weather, with buildings grouped around it. Typical buildings include a warehouse, handling the smaller gas and electric supplies and equipment; shop facilities for the maintenance of



Santa Rosa service group. Warehouse and storage sheds on left, shops and garage on right.

electric transmission equipment, transformers and meters; a shop for the repair and adjustment of gas meters and regulators; a garage and automotive repair shop; and a distribution office which houses the personnel and records of the organization by which the group is administered.



Service group at Hayward, Alameda County.

The service groups are generally situated on the outskirts of the city where a typical industrial type of architecture is suitable. In these instances, a corrugated iron building has been adopted as standard, with a heavy interior timber frame and concrete foundations and floors. A ridged or hipped roof with ventilated monitors and industrial type, ventilated steel sash are typical features of the design. Where the group is situated in a more populous section of a city, the architecture is altered to harmonize with its surroundings, usually necessitating a more expensive brick or tile wall construction with cornice, base, and belt courses.

Since inaugurating its program of service group construction in 1924, the company has completed service units in seventeen different localities at a total expenditure of approximately \$2,100,000, exclusive of the cost of land. They are situated in San Rafael, Santa Rosa, Sacramento, Woodland, Chico, Placerville, Auburn, Colusa, San Francisco, San Mateo, Redwood City, San Jose, Emeryville, Hayward, Concord, Stockton, and Oakdale. A group was also developed at Marysville through the purchase of a group of buildings

in which no material reconstruction was necessary.

Some of the earlier construction consisted of only those facilities needed to round out a satisfactory group, making use of the existing accommodations wherever possible in the new scheme. The new garage at Sacramento, completed in 1927, the shop building at San Rafael, constructed in 1926, and the enlargement of the garage at Stockton are facilities of this type. The more recent projects have been completely integrated groups erected usually on newly acquired property of such size and configuration as to accommodate the typical plan more closely than many of the older groups. The San Francisco service group, which occupies an entire square block between 18th and 19th, Shotwell and Folsom Streets, is the largest and most imposing of its class and second only in importance to the Central Warehouse plant at Emeryville. It was described fully in a previous issue of *PACIFIC SERVICE MAGAZINE*.

Next in importance among the newer service facilities from the standpoint of their size and the functions performed, are the



Service group at Concord, Contra Costa County. Transformer platform and shop shown at left.

groups at San Jose, San Mateo, Redwood City, Santa Rosa, Chico, Hayward, and Concord. Of these, San Mateo may be considered perhaps the most representative of the ideal layout. Situated in a block at Railroad Avenue and "C" Street, it centralizes all operating activities for the

San Francisco peninsula territory between Belmont and San Bruno. The buildings are arranged in the form of a quadrangle around the four sides of the property except where a spur track from the Southern Pacific peninsula lines enters the yard on the west. The pole storage yard and the macadamized areas are entirely within the quadrangle and so arranged in combination with the entrances and exits to the property as to permit an extremely efficient circulation of traffic and the convenient handling of all equipment and supplies. The service groups at Santa Rosa, Concord, and Hayward approach the San Mateo group closely in convenience of operation.

Another group of special interest is that at Placerville. This includes an old pioneer building which had been acquired by the company with the property and which could be suitably adapted to storage purposes. It is an adobe brick building erected in 1852 during the days of the gold rush. To retain its historic interest its walls were left intact and two new buildings were erected to adjoin it on either side. A common brick was chosen for the front walls of the new buildings, ranging in color from salmon to clinker brick and laid up to imitate, as closely as possible, the texture and general appearance of the adobe building. A composition shingle roof in selected colors was placed on all three buildings to bring them in still closer harmony. A tablet placed on the adobe building, dedicated to the memory of the pioneers, tells its story.

The service facility problem is an ever-present one in a utility serving a steadily growing population such as that of our company's system. It requires more or less continuous study and planning by the operating and engineering organizations, and the progressive development of additional plans and designs as the individual needs of the various divisions become apparent. Studies of certain of these requirements are in progress at the present time and will no doubt result in additional construction in the future.



Service group at Placerville, El Dorado County. Note pioneer building at left center.

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Service group at Oakdale, Stanislaus County. Typical of facilities provided at the smaller district headquarters.

## No El Dorado, So Far, But Hope Buoys the Searcher for Gold

Considerable public interest has been aroused by recent accounts of an influx of adventurous unemployed, women as well as men, into the historic mining regions of our "Pacific Service" territory.

Their number is estimated at between 20,000 and 25,000. It may be even more. The greater part are scattered about the banks of well-known rivers, such as the American, Yuba, Stanislaus, Tuolumne and their tributaries, though some are to be found in the foothills, working abandoned claims and digging into slopes that once yielded gold in profusion. They are stimulated in their quest, apparently, not so much by expectation of reviving the glorious days of '49, when sturdy pioneers laid the foundations of fortunes that placed the California millionaire among the financial powers of the country, as by hope of finding at least a sufficient amount of the precious metal to keep body and soul together, a prospect more inviting to them than the risk of facing starvation in the cities and towns from which they came.

Results, so far, have shown that no El Dorado lies within the reach of those prospectors, most of whom are without previous mining experience. There are a few scattered instances of rich strikes—for there is

still gold in California—but for the most part it has been a hard and bitter struggle, with little better than a modest wage for the moderately successful and for others much misery and distress. The eternal hope, however, keeps them going.

The story has its picturesque side, of course. There is the open air life, for one thing. In one respect, at least, the mining prospector of today, however humble his lot, finds himself in better circumstance for the pursuit of his occupation than did his predecessor of the days of '49. He usually possesses some sort of an automobile into which he loads his tent, food supplies, camp equipment and mining outfit. This superior means of transportation enables him to strike camp and move, at will, from one location to another, getting over the ground rapidly and without physical labor. The pioneer prospector enjoyed no such luxury. His means of transportation was Shanks' mare. Packing his blankets and his outfit as best he might he trudged his weary way afoot.

A grub-stake of from \$5 to \$10 enables the prospector to purchase pick, shovel, pan, etc., and some grub. He is set up in business and the rest lies with him and Dame Fortune.

A recent issue of *P. G. and E. Progress*



Charlie Yue, Auburn gold-buyer, at work.

gave an interesting account of conditions in and around Auburn, county seat of Placer, at the base of the great Sierra Nevada made famous by writers of the pioneer times. Scenes there recall those times. Reminiscences of the miners' haphazard system of nomenclature are revived by signs of activity in Shirt Tail Canyon,

Screw Auger Canyon and other locations bearing even less euphonious titles. Picturesque Auburn Ravine, at the foot of the old town, has also come into play, but the majority of the locations dot the banks of the American River. On a recent visit to that district an interesting spectacle was a quite modern tent, with the prospector's wife in charge and a talkative parrot to keep her company. It is by no means unusual for the men to bring their wives along, their children too. While the husband and father is out panning for gold the wife spends a part of the day fishing in the streams, hoping to catch something to relieve the monotony of canned food. The older children, for the most part, work at prospecting while the younger attend classes at nearby schools. One instance of record is of a young boy attending the Auburn High School who pans for gold after school hours and on Saturdays. An average take of \$2.50 a week helps him pay his way.

The principle of placer mining is simple in its essentials. The prospector takes a shovelful of the sandy soil he designates as "pay dirt," places it in his pan and washes it gradually. In this process whatever content



Stone dwelling built by a prospector on his claim located near the Sonora-Angels Camp highway.

there may be of gold dust, being heavier than the sand, sinks to the bottom of the pan. Then quicksilver is added, which assembles the grains of gold into a mass that is technically called "amalgam." This is then wrapped in a piece of chamois-leather, which is wrung to allow most, if not all, of the quicksilver to escape. The soft, spongy mass of gold particles is then ready for disposal to the most available purchaser.

Prospectors in the district mentioned take their clean-up to professional gold buyers in Auburn. The buyer takes the gold mass and first subjects it to intense heat from an acetylene torch. This has the effect not only of

ridding the mass of any quicksilver that may be left but, also, of melting the gold and other baser metals that may be present. In the melting process the baser metals, such as, for instance, copper or lead, turn black, so that the gold is easily distinguishable. Then the buyer determines the carat content of the gold by means of a gold-buyer's stone. This is a



Sluice box constructed along Mormon Creek, a tributary of the Tuolumne River, near Sonora.

hard, black stone four inches long, two inches wide and one-half inch thick. On this the buyer makes a mark with the gold and then determines its carat quality by means of what are known as "gold testers' fingers," pieces of metal two inches long which fit on a key-ring and have solid gold ends, varying, usually, from 24 to 14 carats. Comparison of the color decides the carat content. In this work the buyer is helped out by an accurate knowledge of the gold qualities known to be found in the different districts of the region in which he operates.

While the mark is on the stone the buyer rubs in nitric acid. If the sample is not real gold, or is of less than 14 carat quality, the acid will erase the mark completely. This helps to protect the buyer against attempted fraud. There are several instances of record where men have tried to palm off manufac-



Scene on Jackass Hill, near the historic Mark Twain cabin.

tured nuggets. One piece offered for sale was found to be dotted with particles of molten brass. Some men will take more trouble to get money by that means than by going out and digging up the real article.

The gold buyer's profit lies in re-selling the gold to the United States Mint. The standard price for gold is \$20.67 per ounce, 24 carat. Gold purchased by the buyers ranges from \$8 up to \$18.25, according to quality.

The principal gold buyer in Auburn is Dr. W. F. Durfee, whose father pursued a similar occupation in earlier days. His purchases since August last are said to have averaged about \$100 a day. His biggest purchase of record to date was \$56.20, paid for gold estimated at \$16 per ounce. Another gold buyer is Charlie Yue, a Chinese whose father bought gold in Grass Valley in the '60's. Charlie is credited with having bought \$10,700 worth of gold last year up to November 1. Very small lots, mostly. His biggest single purchase of record was \$128.

Reports from the historic Mother Lode of California state that the region is dotted with tent dwellings, some in solitary ar-



View of the Stanislaus River, near Parrott's Ferry crossing. Miner shown washing a shovelful of gravel.

rangement, others grouped into veritable tent cities. Some prospectors have been fortunate, others have met with mediocre success, while still others have failed and are left stranded. From the mountains of Tuolumne County comes the following, contributed by a correspondent in Sonora:

"The fickle nature of Madam Luck has been aptly illustrated during the recent influx of gold miners.

"One Peter Kaspar started out from Modesto, pushing a wheelbarrow loaded with his belongings, traveled some seventy miles to a stream known as Rose Creek in the vicinity of Columbia. After an absence of two months Kaspar reappeared in the town of Sonora to sell his gold dust. The sale amounted to \$11.64.

"Another man, Jack Herrick, arriving in Jamestown, once a rich gold-bearing district, heard a rumor that a plot of ground about fifty feet square around a seventy-year-old cottonwood tree had never been worked. Herrick sunk a shaft about twenty feet to bedrock, then drifting under the tree struck a rich gold-bearing gravel. He claimed the gravel netted over 50c per pan. At the time this was written Herrick was still panning out gold.

"Perhaps the most lucrative strike in the Tuolumne Mother Lode area during the past year was made by Robert Newmeyer and F. H. Bernard, local men, who joined forces last fall to go digging. For no particular reason they began to excavate in a hole abandoned forty years ago on Jackass Hill, within a stone's throw of the cabin where once lived the famous California humorist, Mark Twain. After having sunk the old shaft about four feet deeper Newmeyer's pick suddenly exposed a mass of shining yellow metal. This nugget assayed over \$1,700, and was just the beginning of a rich find. It is reported that Newmeyer and his partner have taken out over \$40,000 worth of gold from this ledge, and it is still paying.

"While these men can be called lucky, most of the prospectors tell you they are just

making 'beans.' Others are not doing even that. Mr. A. E. Ellree, of Sonora, who buys gold from the miners, states that his purchases vary in size from 21c, the lowest, up to \$57 as the highest, in recent months.

"Although the gold-bearing regions of California have been combed time and again, hundreds of people are grateful today that some of the crumbs, overlooked in the first hectic scramble for the precious metal, remain to be gathered in at a time when those golden grains mean most to their finders."

There is another side of the story, unhappy, not quite so picturesque. Dr. Samuel Johnson once spoke of "the triumph of hope over experience." From accounts so far, this observation would appear to fit the present situation. To begin with, the gold buyers estimate that only about five per cent of the prospectors are men of any mining knowledge. An amateur may be working pay dirt and lose most of his find through inexperience. Then there is the question of find values. A recent article in *The Saturday Evening Post* by an official of the United States Bureau of Mines told of the sufferings of a multitude of deluded people scattered through the mining regions from Dakota to California. This article quoted a value of twenty dollars per ton as being necessary to enable a man working eight hours a day to pan out one dollar's worth of gold, yields by other methods, such as by rocker and sluicing, running a little higher. Now, deposits of pay dirt running \$20 a ton are rare, and while most dirt throughout the mining sections will show traces of gold it is quite another matter when one tries to extract a living for his family through primitive mining methods.

There is much misery, much privation. To mountain counties whose funds for relief work are at best hardly adequate to the needs of their own people who are for the most part taxpayers and are normally engaged in such substantial industries as farming, lumbering or stock-raising, this influx of transients becomes a serious problem.

F. S. M.





William F. Peterson



David Wilkie



Frank A. Estes



Domenic Maliani



Harrison S. Ward



Herschel B. Mathews



David J. O'Brien



James Treverton



Leslie R. Smith



Jacob McGuffin

The "Pacific Service" honor roll. The above pictures are of ten former employees whose long and faithful service has earned them honorable retirement.

## "Pacific Service" Roll of Honor



Heading the honor roll of "Pacific Service" are 139 names of men whose long and faithful service to our company has been rewarded by their honorable retirement with provision for their declining years under our company's pension system which underwent complete revision in the Fall of 1921.

In preceding issues we presented the portraits of men whose names are upon our company's pension roll, accompanied by their several records. In doing this we were actuated by a desire to make our readers acquainted with these men and their records and to point out what is generally recognized in all up-to-date business enterprises, namely, that long and faithful service shall have its reward.

Opposite this will be found another instalment of ten portraits of our company's pensioners. These are:

**David Wilkie.** 78 years of age, having been born September 16, 1854. Entered the service of the Great Western Power Company February 1, 1909, and at the time of his retirement was employed in East Bay Division.

**William F. Peterson.** 76 years of age, having been born December 9, 1856. Entered the service of the Pacific Gas and Electric Company July 6, 1910, and at the time of his retirement was employed in Sacramento Division.

**Frank A. Estes.** 73 years of age, having been born May 13, 1859. Entered the service of the Oro Electric Corporation May 1, 1916, and at the time of his retirement was employed in de Sabla Division.

**Harrison S. Ward.** 71 years of age, having been born June 12, 1861. Entered the service of the Northern California Power Company August 20, 1911, and at the time of his retirement was employed in Shasta Division.

**Domenic Maliani.** 70 years of age, having been born December 5, 1862. Entered the service of the Napa Valley Electric Company in November, 1909, and at the time of his retirement was employed in North Bay Division.

**Herschel B. Mathews.** 70 years of age, having been born August 30, 1862. Entered the service of the Central Electric Railway Company April 1, 1892, and at the time of his retirement was employed in Sacramento Division.

**James Treverton.** 65 years of age, having been born July 15, 1867. Entered the service of the Pacific Gas and Electric Company August 10, 1910, and at the time of his retirement was employed in San Francisco Division.

**David J. O'Brien.** 65 years of age, having been born April 19, 1867. Entered the service of the Independent Light and Power Company November 1, 1900, and at the time of his retirement was employed in San Francisco Division.

**Jacob McGuffin.** 59 years of age, having been born August 7, 1873. Entered the service of the Bay Counties Power Company May 5, 1900, and at the time of his retirement was employed in de Sabla Division.

**Leslie R. Smith.** 48 years of age, having been born December 19, 1884. Entered the service of the Pacific Gas and Electric Company September 10, 1909, and at the time of his retirement was employed in North Bay Division.

## The Financial Side of "Pacific Service"

Following is a consolidated statement of the Pacific Gas and Electric Company's income account, including all subsidiary and affiliated companies, for the year 1932, compared with the preceding year:

### CONSOLIDATED INCOME ACCOUNT

	12 Mos. TO DEC. 31, 1932	12 Mos. TO DEC. 31, 1931	+Increase —Decrease
Gross Revenue, including Miscellaneous Income.....	\$85,517,495	\$88,536,846	—\$3,019,351
Maintenance, Operating Expenses, Taxes (including Federal Taxes) and Reserves for Casualties and Uncollectible Accounts.....	36,941,863	37,512,845	— 570,982
Net Income.....	\$48,575,632	\$51,024,001	—\$2,448,369
Bond Interest and Discount.....	15,996,710	15,367,417	+ 629,293
Balance.....	\$32,578,922	\$35,656,584	—\$3,077,662
Reserve for Depreciation.....	11,426,139	10,865,202	+ 560,937
Surplus.....	\$21,152,783	\$24,791,382	—\$3,638,599
Dividends on Preferred Stock.....	8,022,827	7,803,316	+ 219,511
Balance.....	\$13,129,956	\$16,988,066	—\$3,858,110
Dividends on Common Stock.....	12,501,723	12,191,319	+ 310,404
Balance.....	\$ 628,233	\$ 4,796,747	—\$4,168,514

Gross revenue from sales of electricity decreased as a result of the diminished demand from all classes of power consumers. Other branches of the Company's business also suffered from the generally reduced level of business activity. However, additional gas department sales resulting from the cumulative effect of new business added during the past two years served to offset in some degree the loss of revenue experienced in other branches of activity, the total reduction in gross revenues compared with 1931 aggregating \$3,019,351, or 3.3%.

The careful supervision exercised over all controllable items of operating cost, including payroll reductions affecting the entire personnel, was reflected in a decrease of \$2,632,994 in operating expenses of every character, with the exception of power purchased under existing contracts with other producers. The latter item was in 1932 unusually large, and in 1931 considerably below the average of recent years, due to differences in statewide water conditions. The substantial increase in purchased energy resulting from this condition offset in large measure the operating economies placed in effect by the management.

Total net income, before depreciation, amounted to \$48,575,632, a decrease of \$2,448,369, or about 4½%, but still sufficient to show our operating bond interest earned 3.19 times, with a margin of \$33,361,527 over interest requirements; our preferred stock dividends earned 2.64 times, with a margin of \$13,129,956, and the regular dividends on common stock earned with a margin of \$628,233.

Earnings available for the common stock were equivalent to \$2.10 per share on the average of 6,250,861 shares outstanding during 1932, compared with \$2.79 per share on the average of 6,095,659 shares outstanding during the preceding year. At December 31, 1932, 6,271,778 shares of the Company's common stock were held by the public, upon

which the year's earnings were equivalent to \$2.09 per share. This compares with \$2.73 per share in 1931 upon the 6,232,156 shares of common outstanding at the close of that year.

**CONSOLIDATED BALANCE SHEET, DECEMBER 31, 1932**  
(Including All Subsidiary and Affiliated Companies)

ASSETS		Increase or —Decrease
Plants and Properties.....	\$660,293,078	\$6,455,966
Discount and Expenses on Capital Stock.....	386,269	392,139
Investments (including investment in Standard-Pacific Gas Line, Inc.)....	5,154,862	541,341
Sinking Fund and Other Deposits.....	280,878	21,204
Current Assets:		
Cash .....	\$17,988,068	\$3,243,627
Other Current Assets.....	15,743,163	40,406
Total Current Assets.....	33,731,231	\$3,284,033
Deferred Charges:		
Discount and Expense on Funded Debt.....	\$14,270,766	—\$ 808,846
Unexpired Taxes and Undistributed Suspense Items....	4,204,947	680,500
Total Deferred Charges.....	18,475,713	—\$ 128,346
Total Assets.....	\$718,322,031	\$9,739,651
<b>LIABILITIES</b>		
Common Stock in Hands of Public.....	\$156,797,132	\$ 890,775
Preferred Stock in Hands of Public.....	137,614,507	4,102,250
Minority Interest in Common Stock and Surplus of Subsidiaries.....	213,014	3,789
Funded Debt:		
Pacific Gas and Electric Co., including underlying		
issues.....	\$230,117,900	—\$2,266,000
Affiliated Companies .....	75,857,500	514,000
Total Funded Debt .....	305,975,400	—\$2,780,000
Current and Accrued Liabilities:		
Notes Payable .....	None	—
Current Liabilities .....	\$ 3,688,380	—\$ 782,484
Interest, Taxes and Dividends Accrued but not due....	17,640,892	153,425
Total Current and Accrued Liabilities.....	21,329,272	—\$ 629,059
Reserves:		
For Depreciation .....	\$58,479,137	\$7,203,893
For Insurance and Casualties, etc. ....	5,491,661	228,797
Total Reserves .....	63,970,798	\$7,432,690
Surplus:		
Earned .....	\$30,662,198	\$ 734,235
Capital .....	1,759,710	7,451
Total Surplus.....	32,421,908	\$ 726,784
Total Liabilities .....	\$718,322,031	\$9,739,651

NOTE: Messrs. Haskins & Sells, Certified Public Accountants, are now engaged in their annual audit of the company's accounts. The foregoing statements for the year 1932 are therefore in preliminary form, but it is anticipated that there will be no substantial differences in the final statements certified by the auditors, which will appear in the company's annual report.

# Pacific Service Magazine

PUBLISHED QUARTERLY IN THE INTERESTS OF  
PACIFIC GAS AND ELECTRIC COMPANY

FREDERICK S. MYRTLE · EDITOR-IN-CHIEF

PACIFIC GAS AND ELECTRIC COMPANY  
245 Market St., San Francisco

*The Pacific Gas and Electric Company desires to serve its patrons in the best possible manner. Any consumer not satisfied with his service will confer a favor upon the management by taking the matter up with the division headquarters.*

VOL. XVIII JANUARY, 1933 No. 11

The year 1932 was an unusually trying one for all forms of business enterprise throughout the country. The prevailing depression tended to discourage endeavor and the general policy was one of retrenchment.

The operating gas and electric utilities, generally speaking, weathered the storm in creditable shape. State regulation, for one thing, while limiting the profits of these utilities to a moderate return upon capital investment has had the effect, to a considerable degree, of stabilizing their earnings. But earnings dropped off considerably during the past year and only through the exercise of strict economies of operation have any of these utilities been enabled to carry on and, at the same time, earn a sufficient margin above operating costs and fixed charges to pay dividends to their stockholders. This is particularly true of conditions in the State of California.

These utilities, however, have not been lying down during the depression. On the contrary, they have spent considerable sums of money in improving their generating and distributing facilities in preparation for the time when general business conditions will enable industry to take advantage of the service available. This is in line with their consistent policy. They have not only met the demands of the present but have prepared for the demands of the future. A public utility is a public servant and must be ready when the public calls. Then, these utilities have taken the attitude that the public is entitled to constantly better and cheaper service and each year they have made definite progress in both directions. They have shown faith in the future during an unusually severe period of stress.

Furthermore, these utilities have done as much as lay within their power to alleviate unemployment. They have made a better record in maintaining wage and employment levels than any other major industry during the past three trying years.

The following statement issued to the public press at the beginning of the year by Mr. A. F. Hockenbeamer, our company's president, summarizes the situation:

"The year 1932 served to demonstrate once more the basic soundness of the gas and electric industry in California. That some shrinkage should occur in sales volume was to be expected, particularly in view of the greatly reduced industrial demand occasioned by current economic conditions.

"However, careful supervision of all controllable operating costs served to diminish the effect upon net revenues of these reductions in business volume, and the regular payment of dividends to the 240,000 stockholders of these utilities, of whom four-fifths are California residents, has been continued without any important exception.

"The payment of uninterrupted dividends to this very large number of California investors, in all stations of life, has undoubtedly been an important stabilizing factor during the year.

"While curtailed demand has necessarily resulted in the postponement of important construction projects the California gas and electric utilities have co-operated in efforts to reduce unemployment by spreading available work among as many employees as possible. The Pacific Gas and Electric Company alone, by this means, has succeeded in giving work to 1,700 employees, or 19 per cent of its present personnel.

"It is also continuing its new business activities with unabated vigor, and anticipates the expenditure of approximately one and one-quarter millions of dollars in sales and advertising work during the coming year. This affords, perhaps, the best evidence of our unshaken faith in the continued development of California business."

Of the California gas and electric utilities the Pacific Gas and Electric Company is the largest in capital investment, in magnitude and extent of operation, in service resources and revenues. This company's record for 1932 is disclosed in the statement that in the twelvemonth ending December 31st last gross revenues decreased \$2,906,946, or 3.3 per cent compared with the corresponding

period of 1931, while the net income available for fixed charges decreased \$2,448,369. Bond interest and discount, however, were earned more than three times and earnings available for common stock aggregated \$2.10 per share on an average of 6,250,861 shares of common stock outstanding during the year. Strict economies of operation, of course, were practiced wherever possible. The company continues in a sound financial position, cash on hand December 31st amounting to \$17,988,068, with no uncompleted construction beyond additions and extensions of a routine character.

An unprecedented drop in the electric load was mainly responsible for the decrease in gross revenues. On the other hand, the record for 1932 shows a substantial increase in gas revenues. Natural gas is proving a consistent source of increased revenue for this company. It will be remembered that three years ago the company started serving consumers of the San Francisco bay region with natural gas transmitted at high pressure from the oil fields of the San Joaquin Valley, a distance of 250 miles. The first pipe line was constructed by Pacific Gas and Electric Company on its own account and shortly afterward a second line was built under the joint ownership of P. G. & E., and the Standard Oil Company. The field of distribution has been considerably extended. Since the beginning until at the present time this economical and clean fuel of high heating value (twice that of the artificial product) is now being served to 97.3 per cent of the company's gas consumers. So, it is not surprising to learn that the company is developing new sources of natural gas supply to meet the ever-increasing demand.

When the first instalment of this project was put into operation in August, 1929, by the line from Kettleman Hills oil-field, in Kings County, to the bay, gas was available from only one well. Since that time, however, the drilling of new wells has been carried on. Two areas, known as the North and Middle Domes, have been exploited. At the present time forty-three wells have been completed in the North Dome area and fourteen new wells are being drilled. It has been estimated by geologists that the volume of gas in the North Dome alone is sufficient to supply the demands of northern California for many years to come. In the Middle Dome the first well started producing just a year ago, and it is expected that this field will be

drilled along the same lines as the North Dome, that is one well to every twenty acres of surface area.

The system contains another source of supply in the Buttonwillow gas field, located in Kern County fifty miles south of Kettleman Hills. At the present time there are sixteen completed wells in this field from which gas can be obtained when needed and seven new wells are being drilled.

Pacific Gas and Electric Company's natural gas project has involved an expenditure to date of many millions, but it has proven eminently worth while. The diminution of domestic and other gas bills due to the increased heating value of this over the artificial product is being offset by an intensive selling campaign which the company has prosecuted for the past three years. Natural gas, in addition to its value to the household, is largely displacing all other forms of fuel for industrial purposes.

The rate question continues to be one of constant agitation. It is difficult for the untrained mind to grasp the intricacies of rate schedules and so it is not surprising, perhaps, that from various quarters the suggestion has been advanced that utility rates should decline in proportion to falling commodity prices. The answer to this has been presented more than once. First, under State Commission regulation utilities are at all times prevented from charging more for their services than will provide a reasonable return upon a fair valuation of their properties devoted to the public use, while, on the other hand, unregulated industrial and commercial enterprises are free to charge for their products all that can be obtained under the law of supply and demand. Second, while regulated public utilities have been benefited to some degree by declines in the prices of material and labor such benefits have been more than offset by the decline in gross revenues through reduced demand for service. Third, while private business may, if it will, cease to borrow money, cut expenses to the bone and, if necessary, close up shop to await the return of more prosperous times, the utilities find their plant investment continually increasing in the face of falling revenues while they are obligated to maintain adequate service at any and all times and under any and all circumstances.

Declining material costs are much less important to these industries than to other forms of industrial or commercial enter-

prises. The utilities turn over capital but once in five or more years while manufacturing concerns turn over capital yearly at least. As a result, fixed charges, interest, depreciation and taxes, which represent the main cost of conducting a public utility business, vary but little from year to year. They cannot be appreciably reduced during periods when sales are below normal. So, it is an economic impossibility for them to regulate their rate structures in conformance with changes in the prices of commodities whose turnover and material cost can be adjusted quickly to meet changed conditions.

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Our company is supplying power for construction purposes to the Golden Gate Bridge project, work upon which is already under way.

On the San Francisco side, an 11,000-volt transmission line has been built from our steam-electric plant at North Beach to Fort Point, which marks the southern terminal of what will be the longest suspension bridge in the world. The line is laid underground along the Marina to the Presidio, through which it travels overhead to the fort. There a bank of transformers of 1500 kv.-a. aggregate capacity enables the current to be stepped down to meet requirements. At the Marin end of the span a similar line connects our company's substation at Sausalito with Lime Point, the northern terminal.

Current is supplied from these lines to operate derricks, hoisters, concrete-mixers, air-compressors and other motor-driven equipment and to light buildings and roads.

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#### PASSING OF MR. EDWIN GRUHL

With deep regret we have to record the untimely death of Mr. Edwin Gruhl, a member of our company's board of directors, who passed away in New York City January 22nd.

Mr. Gruhl was born in Milwaukee, Wisconsin, 46 years ago. He was graduated from the University of Wisconsin in 1908 and for a time taught economics there. Then he was employed by the State Railroad Commission of Wisconsin in the capacity of statistician. Later he entered the public utility service and there he may be said to have found his life's work. First he was with the Milwaukee Electric Light and Railway and from that employment he went to the North American Company. There his rise was rapid. He be-

came general manager and, about a year ago, was advanced to the presidency.

He was a high official of many public utility companies. In 1930, following our purchase from the North American Company of controlling interests in the Great Western Power Company and San Joaquin Light and Power Corporation, he was elected a director of "Pacific Service."

Mr. Gruhl had a charming personality and was guided by high ideals. He had the confidence and respect of all who knew him. His passing is not only a great loss to our company but, also, to the public utility industry as a whole.

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#### NOTICE TO OUR READERS

Our company's management regrets to announce its decision to suspend publication of PACIFIC SERVICE MAGAZINE.

This step has been taken only after due consideration. It has been made necessary by existing conditions which render it incumbent upon the company to carry out the strictest economies of operation and to reduce expense wherever possible.

PACIFIC SERVICE MAGAZINE was started in 1909 and during the twenty-four years that have rolled by since its first issue its aim has been to keep the company's stockholders, employees and others interested in the welfare of "Pacific Service" and in the development of the territory covered by its operations fully informed of its progress in every branch of its activities. Through the pages of the magazine may be traced, step by step, every major construction project, every addition to the company's corporate holdings, every expansion of its territory, every notable extension and improvement of its service facilities. It has held the place, therefore, of a quasi-historical journal recording the onward march of "Pacific Service" from almost the date of its incorporation to the present day when the company holds highest rank among the light and power utilities of the country.

But, as already stated, the general policy of today is one of retrenchment in all directions. So, with the present issue, PACIFIC SERVICE MAGAZINE passes. We record here our appreciation of the cordial support it has constantly received from its many thousands of readers and we express the hope that the day is not far distant when the conditions which have brought about its suspension will be but an unpleasant memory.

# PACIFIC GAS AND ELECTRIC COMPANY

A CALIFORNIA CORPORATION

Managed by Californians

Operated by Californians

THE CONSOLIDATED "PACIFIC SERVICE" SYSTEM REPRESENTS (as of December 31, 1932)

10,630 employed in all departments (average for 12 months).

\$660,000,000 capital invested in gas, electric, street railway, steam and water plants.

89,000 square miles of territory in which it operates—an area greater than that of England and Wales.

95,000 stockholders.

46 counties of the State in which it transacts business.

1,257,140 consumers served with gas, electricity, water and steam.

2,760,000 people in 46 counties, which is approximately 50 per cent of the State population.

618 cities and towns in which it supplies service directly and through other companies.

\$19,325,251 annual wages paid employees, year ending December 31, 1932.

\$9,042,098 taxes, Federal, State, county and local, year ending December 31, 1932.

1,178,477 horsepower developed in 50 electric water-power plants.

510,187 horsepower developed in 15 electric steam plants.

1,688,664 total horsepower developed in 65 plants.

2,932,000,578 kw. hours sold, year ending December 31, 1932. This is equivalent to the effort of 9,773,000 men.

35,696,120.900 cubic feet of gas sold, year ending December 31, 1932.

34,752 miles of electric transmission and distribution lines. Greater than the distance around the earth.

7,378 miles of mains used in distributing gas. Greater than the distance between San Francisco and Genoa, Italy.

975 miles of canals, ditches and mains used for power and water supply.

1,370 miles of track of railway supplied with electric power.

664,606,726,000 gallons of water storage capacity of 120 lakes and reservoirs. This amount of water would supply the City of San Francisco at the present rate of consumption for approximately 36 years.

215,607 acres of land owned in California.

650 parcels of property owned in cities and towns.

519,918 horsepower in agricultural motors depending on "Pacific Service."

1,134,368 horsepower in mining, electric railways, manufacturing and other motors depending on "Pacific Service."

3,681,778 horsepower connected to system.

PACIFIC GAS AND ELECTRIC COMPANY

General Offices: 245 Market Street

San Francisco

Branches in all principal cities and towns of 46 counties of Northern and Central California.





